LEVEL

PASSAIC RIVER BASIN
MOLLY ANN BROOK,
PASSAIC COUNTY
NEW JERSEY

OLDHAM POND DAM
NJ 00238

PHASE 1 INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

DEPARTMENT OF THE ARMY

Philadelphia District
Corps of Engineers
Philadelphia, Pennsylvania

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JANUARY 1980

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NJ00238	2. GOVT ACCESSION NO. AD-A087325	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ~~Phase I Inspection Report~~ 6 National Dam Safety Program. Oldham Pond Dam (NJ00238), Passaic River ~~Passaic County, New Jersey~~ Basin, Molly Ann		5. TYPE OF REPORT & PERIOD COVERED 9 FINAL rept. 6. ~~PERFORMING ORG. REPORT NUMBER~~
7. ~~AUTHOR(s)~~ Brook Passaic County, New ~~WARREN A. GUINAN~~ Jersey. Phase 1 Inspection Report.		8. ~~CONTRACT OR GRANT NUMBER(s)~~ 15 DACW61-79-C-0011
9. PERFORMING ORGANIZATION NAME AND ADDRESS Anderson-Nichols & Company, Inc. 6 London Road Concord, New Hampshire 03301		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 12 153
11. CONTROLLING OFFICE NAME AND ADDRESS NJ Department of Environmental Protection Division of Water Resources P.O. Box CN029 Trenton, NJ 08625		12. ~~REPORT DATE~~ 11 Janu[redacted]980 13. ~~NUMBER OF PAGES~~ 122
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office) U.S. Army Engineer District, Philadelphia Custom House, 2d & Chestnut Streets Philadelphia, PA 19106 10 Warren A. Guinan		15. SECURITY CLASS. (of this report) Unclassified 15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from National Technical Information Service, Springfield, Virginia 22151.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dams	
Embankments	Visual Inspection
Structural Analysis	Natinnal Dam Safety Program
Safety	Oldham Pond Dam

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report cites results of a technical investigation as to the dam's adequacy. The inspection and evaluation of the dam is as prescribed by the National Dam Inspection Act, Public Law 92-367. The technical investigation includes visual inspection, review of available design and construction records, and preliminary structural and hydraulic and hydrologic calculations, as applicable. An assessment of the dam's general condition is included in the report.

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SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

410891 JM

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DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106

IN REPLY REFER TO
NAPEN-N

Honorable Brendan T. Byrne
Governor of New Jersey
Trenton, New Jersey 08621

28 JUL 1980

Dear Governor Byrne:

Inclosed is the Phase I Inspection Report for Oldham Pond Dam in Passaic County, New Jersey which has been prepared under authorization of the Dam Inspection Act, Public Law 92-367. A brief assessment of the dam's condition is given in the front of the report.

Based on visual inspection, available records, calculations and past operational performance, Oldham Pond Dam, a high hazard potential structure, is judged to be in poor overall condition. The dam's spillway is considered inadequate since 13 percent of the Probable Maximum Flood (PMF) would overtop the dam. The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the fact that dam failure from overtopping would not significantly increase the hazard to loss of life downstream of the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The owner should develop an emergency action plan and downstream warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

b. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated. In the interim, a detailed emergency operation plan and warning system should be promptly developed. Also, during periods of unusually heavy precipitation, around-the-clock surveillance should be provided.

c. Within six months from the date of approval of this report, engineering studies and analyses should be performed to:

(1) Design and oversee procedures for the removal of trees and brush from the downstream slope and for a distance of 25 feet from the downstream toe of the dam.

(2) Design and oversee repairs for the eroded areas on the downstream slope adjacent to the spillway and at the footpath near the east end of the dam.

(3) Design and oversee repair to the upstream concrete and stone masonry wall for the entire length of the dam.

(4) Design and oversee repairs to the eroded stone masonry walls at the east spillway.

(5) Determine the configuration and condition of the masonry and earth sections of the dam, and its foundation for the purpose of evaluating the stability of the structure.

(6) Investigate the reasons for the uneven surface of the crest, including the area where a hole has been filled with concrete and design remedial measures as needed.

(7) Design and implement necessary remedial measures to prevent erosion of the toe of the dam by water flowing in the discharge channel downstream from the principal spillway.

(8) Investigate the minor seepage through the foundation under the center emergency spillway.

(9) Design and implement repairs for the eroded area on the east bank of the discharge channel immediately downstream of the principal spillway (immediately adjacent to the roadway at the east abutment).

d. Because Oldham Pond Dam is a high hazard dam in poor overall condition, maintenance of normal pool at a lower level should be considered until the remedial measures outlined above can be effected.

e. Within six months from the date of approval of this report the following actions should be initiated:

(1) Cut small trees growing in the masonry wall on the upstream side of the crest of the dam.

(2) Clear trees and brush from the discharge channel for some distance downstream of the dam.

(3) Start a program for maintaining the embankment free of weeds, brush, and trees.

(4) Repair the horizontal construction joints in the west emergency spillway face.

(5) Periodically operate the low-level outlet valve.

f. The owner should develop operating procedures and periodic maintenance plans to ensure the safety of the dam.

NAPEN-N
Honorable Brendan T. Byrne

A copy of the report is being furnished to Mr. Dirk C. Hofman, New Jersey Department of Environmental Protection, the designated State Office contact for this program. Within five days of the date of this letter, a copy will also be sent to Congressman Roe of the Eighth District. Under the provision of the Freedom of Information Act, the inspection report will be subject to release by this office, upon request, five days after the date of this letter.

Additional copies of this report may be obtained from the National Technical Information Services (NTIS), Springfield, Virginia 22161 at a reasonable cost. Please allow four to six weeks from the date of this letter for NTIS to have copies of the report available.

An important aspect of the Dam Inspection Program will be the implementation of the recommendations made as a result of the inspection. We accordingly request that we be advised of proposed actions taken by the State to implement our recommendations.

Sincerely,

James G. Ton

1 Incl
As stated

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

Copies furnished:
Mr. Dirk C. Hofman, P.E., Deputy Director
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P.O. Box CN029
Trenton, NJ 08625

Mr. John O'Dowd, Acting Chief
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OLDHAM POND DAM (NJ00238)

CORPS OF ENGINEERS ASSESSMENT OF GENERAL CONDITIONS

This dam was inspected on 7 November 1979 by Anderson-Nichols & Co., Inc. under contract to the State of New Jersey. The State, under agreement with the U.S. Army Engineer District, Philadelphia, had this inspection performed in accordance with the National Dam Inspection Act, Public Law 92-367.

Oldham Pond Dam, a high hazard potential structure, is judged to be in poor overall condition. The dam's spillway is considered inadequate because a flow equivalent to 13 percent of the Probable Maximum Flood (PMF) would cause the dam to be overtopped. The decision to consider the spillway "inadequate" instead of "seriously inadequate" is based on the fact that dam failure from overtopping would not significantly increase the hazard to loss of life downstream of the dam from that which would exist just before overtopping failure. To ensure adequacy of the structure, the following actions, as a minimum, are recommended:

a. The owner should develop an emergency action plan and downstream warning system outlining actions to be taken by the operator to minimize downstream effects of an emergency at the dam.

b. The spillway's adequacy should be determined by a qualified professional consultant engaged by the owner using more sophisticated methods, procedures and studies within six months from the date of approval of this report. Within three months of the consultant's findings, remedial measures to ensure spillway adequacy should be initiated.

c. Within six months from the date of approval of this report, engineering studies and analyses should be performed to:

(1) Design and oversee procedures for the removal of trees and brush from the downstream slope and for a distance of 25 feet from the downstream toe of the dam.

(2) Design and oversee repairs for the eroded areas on the downstream slope adjacent to the spillway and at the footpath near the east end of the dam.

(3) Design and oversee repair to the upstream concrete and stone masonry wall for the entire length of the dam.

(4) Design and oversee repairs to the eroded stone masonry walls at the east spillway.

(5) Determine the configuration and condition of the masonry and earth sections of the dam and its foundation for the purpose of evaluating the stability of the structure.

(6) Investigate the reasons for the uneven surface of the crest, including the area where a hole has been filled with concrete and design remedial measures as needed.

(7) Design and implement necessary remedial measures to prevent erosion of the toe of the dam by water flowing in the discharge channel downstream from the principal spillway.

(8) Investigate the minor seepage through the foundation under the center emergency spillway.

(9) Design and implement repairs for the eroded area on the east bank of the discharge channel immediately downstream of the principal spillway (immediately adjacent to the roadway at the east abutment).

d. Because Oldham Pond Dam is a high hazard dam in poor overall condition, maintenance of normal pool at a lower level should be considered until the remedial measures outlined above can be effected.

e. Within six months from the date of approval of this report the following actions should be initiated.

(1) Cut small trees growing in the masonry wall on the upstream side of the crest of the dam.

(2) Clear trees and brush from the discharge channel for some distance downstream of the dam.

(3) Start a program for maintaining the embankment free of weeds, brush, and trees.

(4) Repair the horizontal construction joints in the west emergency spillway face.

(5) Periodically operate the low-level outlet valve.

f. The owner should develop operating procedures and periodic maintenance plans to ensure the safety of the dam.

APPROVED: James G. Ton

JAMES G. TON
Colonel, Corps of Engineers
District Engineer

DATE: 14 Jun 1980

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Oldham Pond Dam
Identification No.:	Fed ID No. NJ00238
State Located:	New Jersey
County:	Passaic
Stream:	Molly Ann Brook
River Basin:	Passaic
Date of Inspection:	7 November 1979

ASSESSMENT OF GENERAL CONDITIONS

Oldham Pond Dam is approximately 130 years old and is in poor overall condition. It is small in size and is classified as high hazard. The downstream slope of the embankment is covered by thick vegetation. Eroded areas on the downstream slope adjacent to the spillways were observed. Erosion was noted downstream of the principal spillway. Oldham Pond Dam has three spillways and together they are inadequate in their carrying capacity. The spillways can pass less than 12 percent of the PMF.

It is recommended that the owner retain the services of a professional engineer, qualified in the design and inspection of dams, to accomplish the following in the near future: design and oversee procedures for the removal of trees and brush from the downstream slope and for a distance of 25 feet from the downstream toe of the dam; design and oversee repairs for the eroded areas on the downstream slope adjacent to the spillways and at the footpath near the east end of the dam; design and oversee repair to the upstream concrete and stone masonry wall for the entire length of the dam; design and oversee repairs to the eroded stone masonry walls at the east spillway; determine the configuration and condition of the masonry and earth sections of the dam, and the foundation conditions, for the purpose of evaluating the stability of the dam; investigate the reasons for the uneven surface of the crest, including the area where a hole has been filled with concrete and design remedial measures as needed; design and implement necessary remedial measures to prevent erosion of the toe of the dam by water flowing in the discharge channel downstream from the principal spillway; investigate the minor seepage through the foundation under the center emergency spillway; design and implement repairs to the eroded area on the east bank downstream of the principal spillway discharge channel; further evaluate the hydrology and hydraulics of the watershed, reservoir, dam and spillways using a more detailed analysis and design and implement appropriate mitigating measures. The owner should accomplish the following soon: cut small trees growing in the masonry wall on the upstream side of the crest of the dam and clear trees and brush from all discharge channels and on either side of each discharge channel for some distance downstream of the dam. In the near future the owner should: start a program for maintaining the embankment free of weeds, brush and

trees; establish a surveillance program for use during and immediately after periods of heavy rainfall, and also a warning program to follow in case of emergency conditions; repair the horizontal construction joints in the west emergency spillway face; periodically exercise the low-level outlet valve. Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.

ANDERSON-NICHOLS & COMPANY, INC.

Warren A. Guinan

Warren A. Guinan, P.E.
Projecc Manager
New Jersey 16848

OVERVIEW
OLDHAM POND DAM

7 NOVEMBER 1979

CONTENTS

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY REPORT

OLDHAM POND DAM FED ID NO. NJ00238 NJ NO. 400A

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D.C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the Spillway Test Flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The test flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY INSPECTION PROGRAM
OLDHAM POND DAM
FED ID NO. NJ00238 NJ NO. 400A

SECTION 1
PROJECT INFORMATION

1.1 General

a. Authority. Authority to perform the Phase I Safety Inspection of Oldham Pond Dam was received from the State of New Jersey, Department of Environmental Protection, Division of Water Resources by a letter dated 26 October, 1979, under Contract FPM No. 39 dated 28 June 1978. This authority was given pursuant to the National Dam Inspection Act, Public Law 92-367 and by agreement between the State and the U.S. Army Engineers District, Philadelphia. The inspection discussed herein was performed by Anderson-Nichols & Co., Inc. on 7 November 1979.

b. Purpose. The purpose of the Phase I Investigation is to develop an assessment of the general conditions with respect to the safety of Oldham Pond Dam and appurtenances based upon available data and visual inspection, and, determine any need for emergency measures and conclude if additional studies, investigations and analyses are necessary and warranted.

1.2 Project Description

a. Description of Dam and Appurtenances. Oldham Pond Dam is a 18 foot high, 850 foot long earth embankment dam built between 1834 and 1875 and reconstructed in 1902 and 1945. The downstream face of the dam is earth with a 2H:1V slope. The upstream face of the dam is a wall of masonry and concrete and is vertical. Oldham Pond Dam has three spillways. The principal spillway is adjacent to Church Street on the east abutment. The center spillway is 400 feet west of the east abutment. The west spillway is 650 feet west of the east abutment. The center and west spillways function as emergency spillways. The principal spillway is a 39 foot long free overflow flat-crested spillway. It is concrete capped masonry and discharges over two steps into the downstream channel. The central emergency spillway is a 100 foot long, free overflow, broad crested spillway. The downstream face of this spillway is vertical. The west emergency spillway is a 56 foot long, free overflow, concrete ogee spillway. A training wall paralleling Church Street forms the east abutment of the dam. Adjacent to the west abutment is a small wooden structure housing an intake control mechanism for the 12 inch factory supply line. A low-level outlet control mechanism access is on the crest 350 feet from the left abutment. The low-level outlet is a box culvert 2.5 feet wide by 3.0 feet high. Essential features of the dam are given in Figure 1 and Figure 2.

b. Location. The dam is located in Passaic County, New Jersey on Molly Ann Brook, a tributary to the Passaic River in North Haledon, a suburb of Paterson, New Jersey. It is at north latitude 40° 56.7' and west longitude 74° 11.0'. A location map is given in Figure 3.

c. Size Classification. Oldham Pond Dam is classified as being "small" in size in accordance with criteria given in the Recommended Guidelines for Safety Inspection of Dams on the basis of storage at the dam crest of 77 acre-feet, which is less than 1000 acre-feet, but more than 50 acre-feet, and on a height of 18 feet, which is less than 40 feet.

d. Hazard Classification. Visual inspection of the downstream area and the breach analysis contained herein shows that a breach of Oldham Pond Dam could cause excessive damage to 10 or more residences located downstream of the dam and the potential exists for loss of 30 or more lives. Accordingly, Oldham Pond Dam is classified as High Hazard.

e. Ownership. The dam is owned by Harmon Colors Corporation, P.O. Box 419, Hawthorne, New Jersey, 07507, Telephone (201)-942-3232. Mr Willaim Pratt of Harmon Colors Corporation is the maintenance manager and oversees the dam safety.

f. Purpose of Dam. Oldham Pond Dam was originally designed and is currently used for industrial water supply.

g. Design and Construction History. Little information regarding the original design and construction of the original dam was revealed. Two undocumented "original construction dates" were made known. These are 1834 and 1875. Also undocumented was a repair and reconstruction of the dam as a result of the 1902 flood. The first written history of the dam describes repairs and reconstruction of the structure and appurtenances after the 23 July 1945 flood. Historical evidence reveals that in 1963 extensive rebuilding of the west and east spillways was performed. Pressure grouting and intrusion grouting was accomplished on the center emergency spillway in 1968, 1970, and 1978. Also in 1978, the center emergency spillway "fabriform" concrete mattress applied to the spillway crest. The change in surface area resulting from the various modifications was not available.

h. Normal Operational Procedures. The current Safety Supervisor for Harmon Colors Corporation, Mr. Charles Macri, indicated that the low-level outlet has been operated at irregular intervals. The factory intake mechanism on the right abutment is operable. No formal written operating procedures were revealed.

i. Site Geology. No site specific geologic information (such as borings) was available at the time the dam was inspected. Information derived from a report entitled "Engineering Geology of the Northeast Corridor, Washington, DC to Boston, MA" and the Geologic Map of New Jersey (Kummel and Johnson, 1912) indicate that soils within the immediate site area consist of ground moraine overlying bedrock. Although outcrops were not observed during inspection of this dam, the previously mentioned report indicates that the underlying bedrock consists of basalt flows, and associated diabase dikes and sills, of Triassic age.

1.3 Pertinent Data

a. Drainage Area

5.3 square miles

b. Discharge at Damsite (cfs)

Maximum known flood at damsite - 2370, 23 July 1945

Low level outlet at pool elevation - 148

Total spillway capacity at maximum pool elevation - 3179

c. Elevation (ft. above NGVD)

Top of dam - 206.7

Design surcharge (PMF) - 210.5

Spillway crest (principal spillway) - 202.7

Spillway crest (center emergency spillway) - 203.7

Spillway crest (west emergency spillway) - 203.7

Downstream invert low-level outlet - 190.7

Streambed at centerline of dam - 190.7

Maximum tailwater - 192.4

d. Reservoir

Length of maximum pool (estimated) - 1400 feet

Length of normal pool - 1300 feet

e. Storage (acre-feet)

Normal pool - 77

Design surcharge (PMF) - 236

Spillway crest - 77

Top of dam - 153

f. Reservoir Surface (acres)

Top of dam - 20

Spillway crest - 17

g. Dam

Type - earth embankment with vertical masonry and concrete wall on upstream face

Length - 850± feet

Height - 18 feet

Topwidth varies from 20 to 45 feet

Side slopes - upstream: vertical; downstream: varies from vertical to 3H:1V.

Zoning - unknown

Impervious core - unknown

Cutoff - unknown

Grout curtain - unknown

h. Spillways

Principal spillway

Type - free overflow flat crested concrete capped masonry

Length - 39 feet

Crest elevation - 202.7

Gates - none

Central emergency spillway

T - free overflow broad crested "fabriform" concrete mattress capped masonry

Length - 100 feet

Crest elevation - 203.7 NGVD

Gates - none

West emergency spillway

Type-free overflow concrete ogee

Length - 56 feet

Crest elevation - 203.7 NGVD

Gates - none

Upstream channel - Oldham Pond

Downstream channel - Molly Ann Brook

i. Outlet Works

1 - 2.5 ft. x 3.0 ft. box culvert low-level outlet beneath dam on the crest at a point 350 feet west of the east abutment. Valving mechanism not observed under locked access doors.

1 - 12-inch line of unknown material, used for industrial water supply intake line; valving mechanism in small wooden structure adjacent to west abutment.

SECTION 2
ENGINEERING DATA

2.1 Design

No original plans, hydraulic or hydrologic data for Oldham Pond Dam were available. Reconstruction plans by Justin & Courtney of Philadelphia for the rebuilding in 1963 of the principal spillway and west emergency spillway were obtained.

2.2 Construction

No data concerning the original construction of Oldham Pond Dam were revealed. Communication with Mr. William Pratt indicates that the dam was originally built between 1834 and 1875. It is unknown who constructed the original dam. Additional original construction information was not revealed.

2.3 Operation

No engineering operational data were divulged.

2.4 Evaluation

a. Availability. A search of the New Jersey Department of Environmental Protection files and contact with representatives of the owner of the dam revealed only a limited amount of recorded information. All available information was retrieved.

b. Adequacy. Because of the limited amount of recorded information available, evaluation was based primarily on visual observations.

c. Validity. The recorded data retrieved were found to be in general agreement with visual observations.

SECTION 3
VISUAL INSPECTION

3.1 Findings

a. Dam. The downstream slope of the dam is covered with a very dense growth of trees and brush which makes it impossible to inspect the downstream slope adequately. At one location near the east abutment there is a footpath which is bare of vegetation from the crest to the toe of the slope. Considerable erosion of the downstream slope of the embankment has occurred next to the west end of the west emergency spillway and near the west and east ends of the center emergency spillway.

The crest of the dam is uneven and is mostly covered with grass and coarse weeds which make it difficult to inspect the crest adequately. At one point where a crack in the vertical masonry wall on the upstream edge of the crest was observed, a subsidence has occurred in the crest of the embankment next to the wall and that subsidence has been filled with concrete. Voids were noted in the embankment beneath this concrete. At one location on the crest small trees are growing out of the vertical masonry wall on the upstream side of the crest. The concrete faced and capped stone masonry wall on the upstream face of the dam has numerous areas of spalling and erosion. Substantial cracking and chipping of the mortared stone masonry wall was noted. Numerous vertical cracks in the upstream concrete wall exist.

b. Appurtenant Structures. Minor leakage is occurring through the foundation of the center emergency spillway. Two horizontal construction joints of the west emergency spillway face exhibit efflorescence and minor seepage. The surface of the west emergency spillway has some minor surface erosion and the stone masonry walls are undermined in several places along the concrete spillway apron.

c. Reservoir Area. The watershed immediately above the pond is gently to moderately sloping and heavily urbanized. Church Street runs parallel to the east edge of the reservoir. The reservoir slopes appear to be stable. No evidence of significant sediment was observed. Some trees are overhanging the pond at the approach to the intake structure at the east abutment.

d. Downstream Channel. The channels downstream of the center emergency spillway and the west emergency spillway are filled with trees and brush.

The channel downstream of the principal spillway at the east abutment makes a right-angle turn and runs along the toe of the embankment for about 80 feet before making another turn downstream. The channel bottom is in soil and no erosion protection exists on the side of the channel adjacent to the dam toe. Major erosion is occurring in the east bank of this channel immediately downstream of the training wall on the east side of the principal spillway.

SECTION 4
OPERATIONAL PROCEDURES

4.1 Procedures

No formal operating procedures were found. Normal operating procedures are described in Section 1.2 h.

4.2 Maintenance of Dam

No formal maintenance procedures for the low-level outlet and industrial supply line were revealed. From the condition of the dam and appurtenant structures it is apparent that a regular maintenance program has not been followed.

4.3 Maintenance of Operating Facilities

No formal maintenance procedures for the operating facilities were made known.

4.4 Warning System

No description of any warning system was unveiled

4.5 Evaluation of Operational Adequacy

Because of the lack of operation and maintenance procedures, the remedial measures described in Section 7.2 should be implemented as prescribed.

SECTION 5
HYDROLOGY AND HYDRAULIC ANALYSIS

5.1 Evaluation of Features

a. Design Data. Because no original design data were available, an evaluation could not be performed. Reference data from NJDEP files revealed limited information.

b. Experience Data. Data retrieved from NJDEP files revealed that several inspections have been performed on Oldham Pond Dam. A report on a dam inspection was filed by George R. Shanklin, Assistant Chief Engineer, State of New Jersey, State Water Policy Commission, on 19 September 1945. In this report, Mr. Shanklin noted "that while the main dam was slightly overtopped at points by the 23 July (1945) flood, no appreciable damage was suffered by any of the three spillways or the high part of the embankment". Additional inspections were performed on the following dates: 1 October 1945, 26 February 1946, 13 December 1949, 14 March 1955, 21 October 1960, 26 July 1962, and 17 September 1963. These inspections did not reveal any additional information concerning past embankment overtopping.

c. Visual Observations. No visual evidence of damage due to overtopping was observed. At the time of inspection, approximately 0.2 foot of water was flowing over the principal spillway crest and no water was flowing over either emergency spillway.

d. Overtopping Potential. The hydraulic/hydrologic evaluation for Oldham Pond Dam is based on a selected Spillway Design Flood (SDF) equal to the Probable Maximum Flood (PMF) in accordance with the range of test floods given in the evaluation guidelines for dams classified as high hazard and small in size. The PMF has been determined by application of the SCS Dimensionless Unit Hydrograph procedure to the 6-hour probable maximum storm of 24.8 inches. Hydrologic computations are given in Appendix 3. The routed PMF outflow peak discharge under breach and non-breach conditions at the dam and at the downstream cross section is approximately 27500 cfs. The minimum elevation of the dam allows 4.0 feet of depth in the principal spillway and 3.0 feet of depth in the emergency spillways before overtopping occurs. The low-level outlet is assumed closed. Under this head, the total spillways' capacity is 3179 cfs, which is less than the required SDF.

Flood routing calculations indicate that Oldham Pond Dam will be overtopped for nearly four hours to a maximum depth of 2.4 feet over the dam crest under PMF conditions. It is estimated that the spillways can pass less than 12 percent of the PMF without overtopping.

After passing over Oldham Pond Dam, the discharge channel, Molly Ann Brook, parallels Church Street. Approximatley 15 houses line the west side of Church Street downstream of Oldham Pond Dam. The outflow from the dam was routed through a cross-section representative of the downstream area. The depths occurring at this section determines the depth of flooding and inundation for the Church Street residences. From the analysis it was determined that under PMF conditions that area adjacent to Molly Ann Brook would experience inundation of 10 feet. The results of the breach analysis, contained in Appendix 3, indicate the breaching of the dam does not significantly increase the hazard downstream over the non-breach condition at the chosen cross section. The dam is classified as high hazard and the spillway can pass less than 50 percent of the PMF without causing overtopping, however, the hazard to loss of life is not significantly increased because of dam failure, thus the spillway is considered inadequate.

e. Drawdown Capability. If the low-level outlet currently in place is fully operable it is estimated that the pond can be drained in approximately 0.8 day, assuming no significant inflow. This time period is considered adequate for draining the reservoir in an emergency situation.

SECTION 6
STRUCTURAL STABILITY

6.1 Visual Observations

The presence of a dense growth of trees and brush on the downstream slope and grass and coarse weeds on the crest of the embankment makes it impossible to make an adequate visual inspection of the embankment.

The trees growing on the downstream slope of the embankment and in the area downstream of the toe may blow over and pull out their roots or they may die with the results that their roots rot. In either case, serious seepage and erosion problems could result.

Erosion at the west end of the west emergency spillway and at the west and east ends of the center emergency spillway, if not controlled, could lead to a breach of the embankment and could also contribute to stability problems in the spillway structures themselves.

A footpath, bare of vegetation, from the crest to the downstream toe of the embankment is susceptible to erosion and consequent damage to the embankment due to both runoff of rainfall and, if it should occur, overtopping.

The crest of the dam is uneven. Although the cause of the unevenness cannot be determined on the basis of the visual inspection alone, it may be a sign of a potential stability problem The presence of a sinkhole (which has been filled with concrete and has subsequently increased in extent) is a sign of internal erosion of the embankment which, if not stopped, could lead to breaching of the dam. This sinkhole may be the result of loss of material through the masonry wall toward the reservoir, piping toward the downstream side of the embankment, or some combination of the two. Continued deterioration of the concrete and stone masonry wall upstream could lead to major seepage through the wall and erode the embankment fill.

Flow of water in the discharge channel from the principal spillway along the toe of the dam could erode the toe of the embankment and result in a failure of the embankment.

Erosion of the left bank of the discharge channel immediately downstream of the principal spillway may undermine Church Street on the east abutment and may also undermine the spillway structure.

Minor leakage through the foundation of the center emergency spillway could lead to a stability problem.

Based on the visual inspection alone, it is not possible to determine the character of the dam and spillway foundations, or the interior of the cross-section of the embankment, or the shape of the upstream side of the embankment and spillways. It is therefore not possible to evaluate the factor of safety of the dam and spillways against slope failure, sliding, or overturning.

6.2 Design and Construction Data

No design or construction data pertinent to the structural stability of the dam are available.

6.3 Operating Records

No operating records pertinent to the structural stability of the dam are available.

6.4 Post-Construction Changes

The dam was originally built between 1834 and 1875. Following severe flooding in 1902, the dam was reconstructed. It is unknown who did the reconstruction work. The county rebuilt the Church Street training wall in 1945. Complete reconstruction of the west emergency spillway was performed in 1963. The consulting engineers for the work was Justin and Courtney of Philadelphia. In 1978 the center emergency spillway had its training walls rebuilt and the crest capped. This work was done by Raymond International. Additional "post-construction" information is discussed in Section 1.2, g. (Design and Construction History). No further post-construction changes relative to Oldham Pond Dam's structural stability were revealed.

6.5 Seismic Stability

This dam is in Seismic Zone 1. According to the Recommended Guidelines, dams located in Seismic Zone 1 "may be assumed to present no hazard from earthquake provided static stability conditions are satisfactory and conventional safety margins exist." None of the visual observations made during the inspection are indicative of unstable slopes. However, because no data are available concerning the engineering properties of the embankment and foundation materials for this dam or of the below-ground configuration of the masonry spillways, it is not possible to make an engineering evaluation of the stability of the slopes or the factor of safety under static conditions.

SECTION 7
ASSESSMENT, RECOMMENDATIONS/REMEDIAL MEASURES

7.1 Dam Assessment

a. Condition. Oldham Pond Dam is about 130 years old and is in poor overall condition.

b. Adequacy of Information. The information available is such that the assessment of this dam must be based primarily on the results of the visual inspection.

c. Urgency. The recommendations made in Sections 7.2 a. and 7.2 c. should be implemented by the owner as prescribed below.

d. Necessity for Additional Data/Evaluation. The information available from the visual inspection is adequate to identify the potential problems which are listed in 7.2 a. below. These problems require the attention of a professional engineer qualified in the design and construction of dams who will have to make additional engineering studies to design or specify remedial measures to rectify the problems. If left unattended,the problems could lead to instability of the structure.

7.2 Recommendations/Remedial Measures

a. Recommendations. The owner should retain a professional engineer qualified in the design and construction of dams to accomplish the following in the near future:

(1) Design and oversee procedures for the removal of trees and brush from the downstream slope and for a distance of 25 feet from the downstream toe of the dam.

(2) Design and oversee repairs for the eroded areas on the downstream slope adjacent to the spillways and at the footpath near the east end of the dam.

(3) Design and oversee repair to the upstream concrete and stone masonry wall for the entire length of the dam.

(4) Design and oversee repairs to the eroded stone masonry walls at the east spillway.

(5) Determine the configuration and condition of the masonry and earth sections of the dam, and the foundation conditions, for the purpose of evaluating the stability of the dam.

(6) Investigate the reasons for the uneven surface of the crest, including the area where a hole has been filled with concrete and design remedial measures as needed.

(7) Design and implement necessary remedial measures to prevent erosion of the toe of the dam by water flowing in the discharge channel downstream from the principal spillway.

(8) Investigate the minor seepage through the foundation under the center emergency spillway.

(9) Design and implement repairs for the eroded area on east bank of the discharge channel immediately downstream of the principal spillway (immediately adjacent to the roadway at the east abutment).

(10) Further evaluate the hydrology and hydraulics of the watershed, reservoir, dam and spillway using a more detailed analysis and design and implement appropriate mitigating measures.

b. Alternatives. Because Oldham Pond Dam is a high hazard dam in poor overall condition, maintenance of normal pool at a lower level should be considered until the remedial measures outlined above can be effected.

c. Operating and Maintenance Procedures. The owner should accomplish the following soon:

(1) Cut small trees growing in the masonry wall on the upstream side of the crest of the dam.

(2) Clear trees and brush from the discharge channels and on either side of each discharge channel for some distance downstream of the dam.

The owner should accomplish the following in the near future:

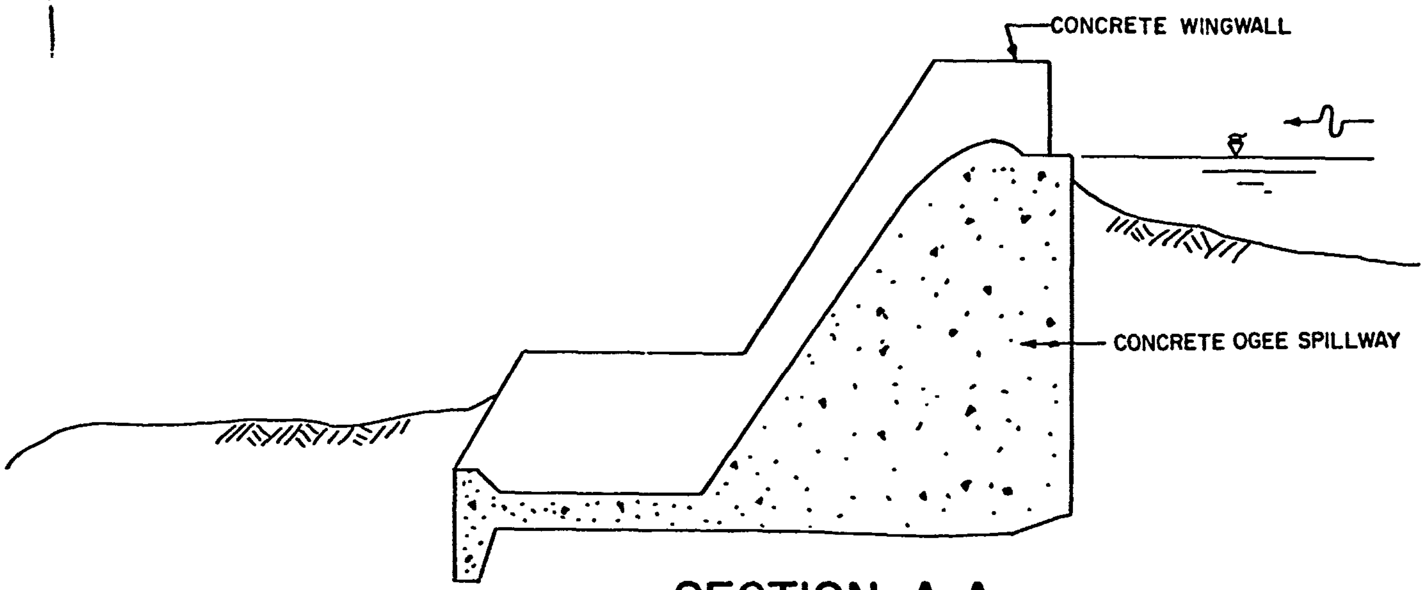
(1) Start a program for maintaining the embankment free of weeds, brush, and trees.

(2) Establish a surveillance program for use during and immediately after periods of heavy rainfall, and also a warning program to follow in case of emergency conditions.

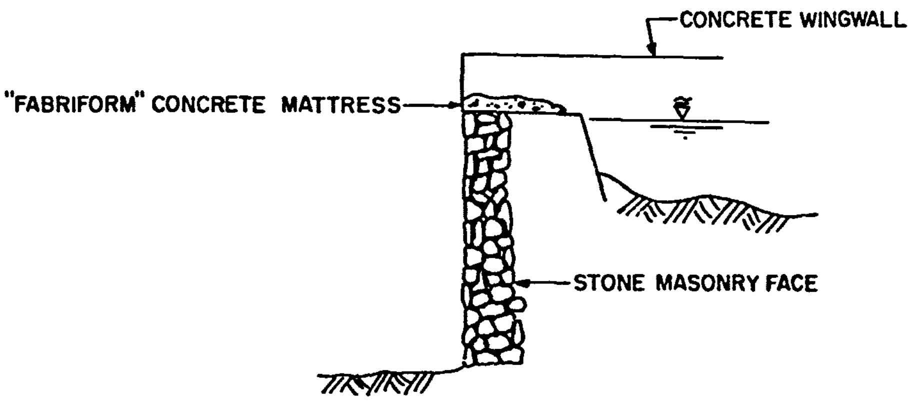
(3) Repair the horizontal construction joints in the west emergency spillway face.

(4) Periodically operate the low-level outlet valve.

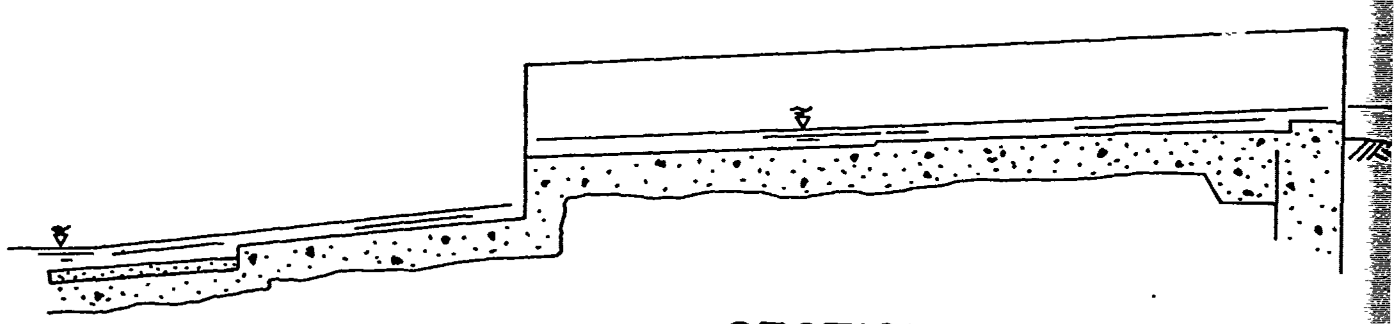
Within one year from the date of approval of this report, the owner should develop written operating procedures and a periodic maintenance plan to insure the safety of the dam.



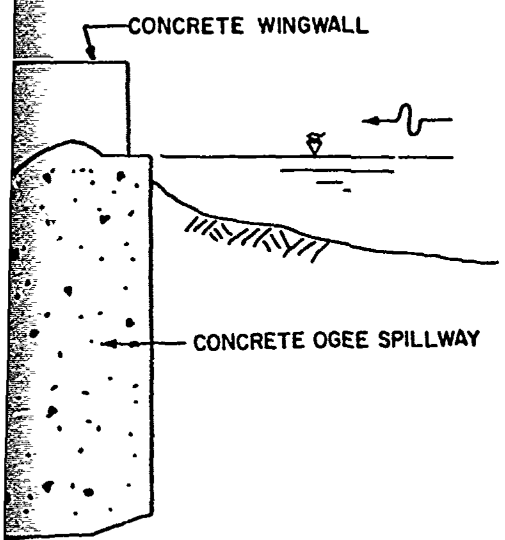
SECTION A-A
(EMERGENCY SPILLWAY WEST)



SECTION B-B
(EMERGENCY SPILLWAY CENTER)

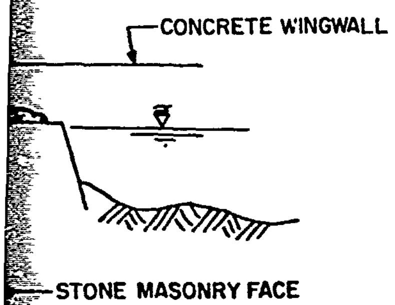


SECTION C-C
(PRINCIPAL SPILLWAY)



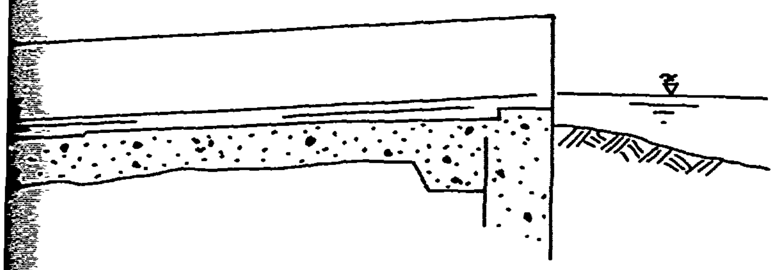
A-A

LWAY WEST)



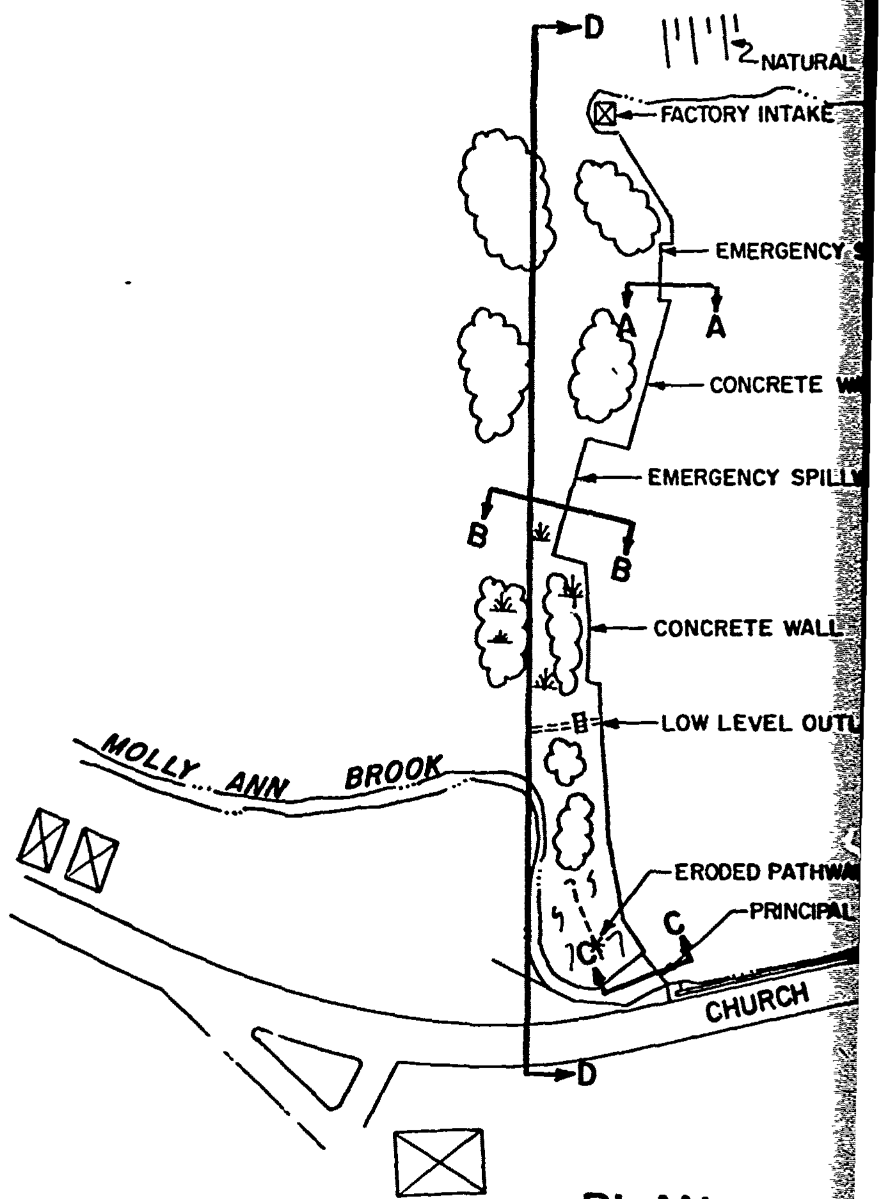
ON B-B

PILLWAY CENTER)



CTION C-C

PAL SPILLWAY)

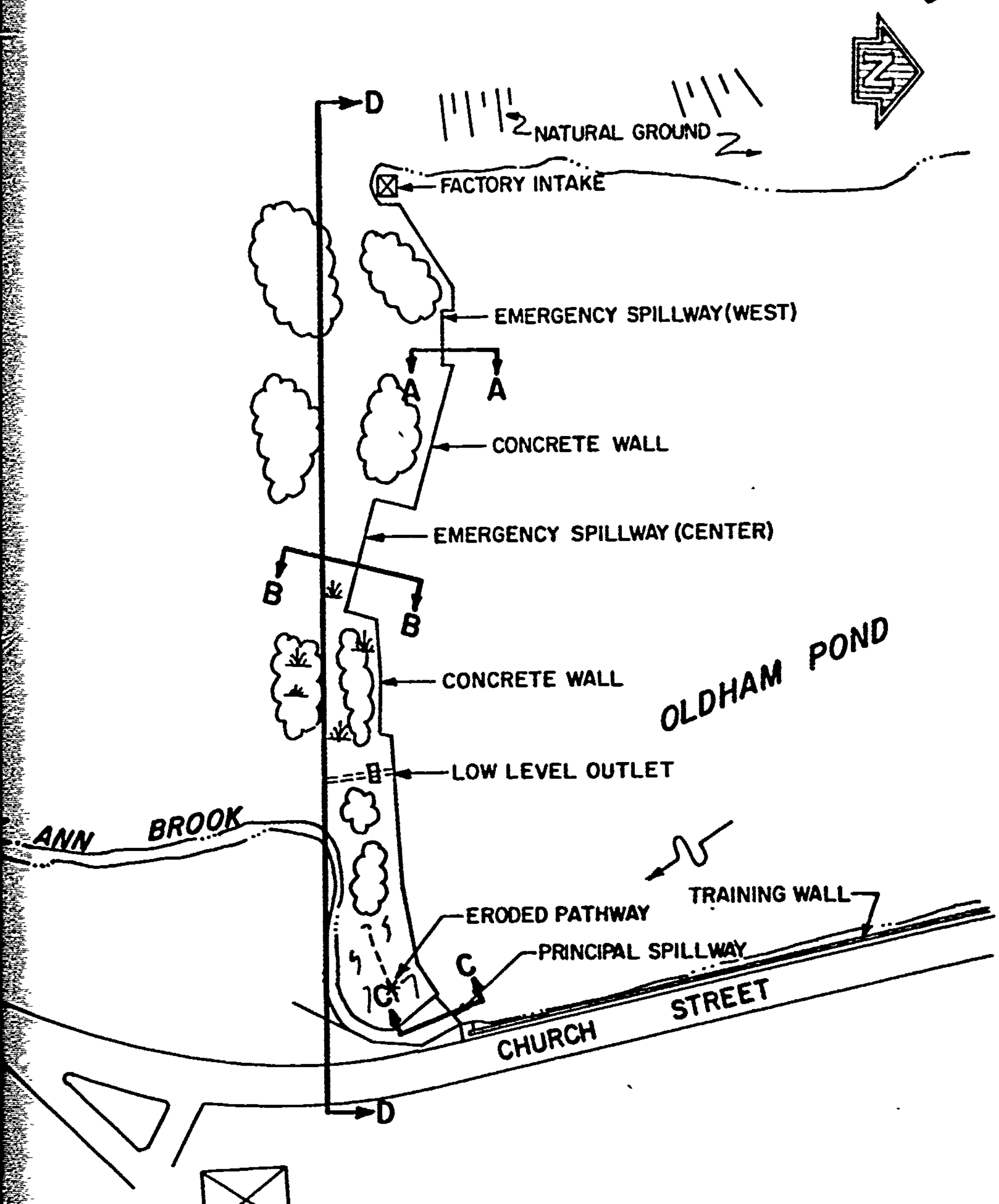


PLAN

DETAIL FROM FIELD INSPECTION 11/6/79

Anderson–Nichols & Co., Inc. CONCORD NEW HAMPSHIRE			U.S. ARM
NATIONAL PROGRAM OF INSPECTI OLDHAM POND MOLLY ANN BROOK			
			SCALE:
			DATE:

3



PLAN

DETAIL FROM FIELD INSPECTION 11/6/79

Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIST. PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

OLDHAM POND DAM

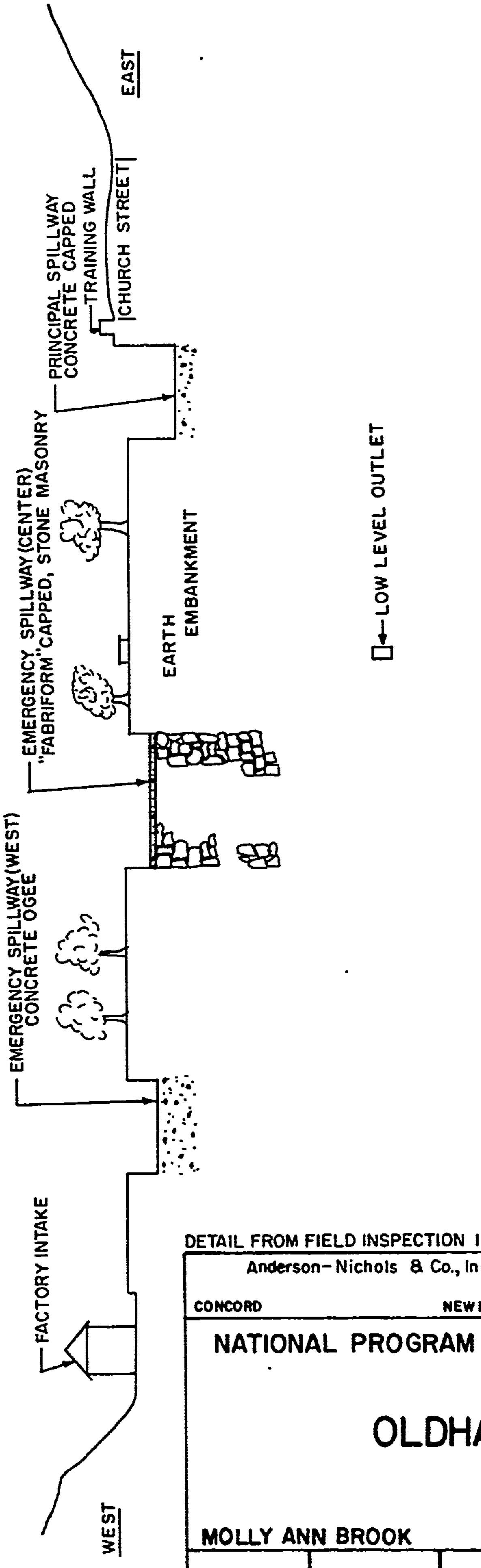
MOLLY ANN BROOK — NEW JERSEY

SCALE: NOT TO SCALE

DATE: JANUARY 1980

FIGURE 1

PRECEDING PAGE BLANK-NOT FILMED



ELEVATION D-D

DETAIL FROM FIELD INSPECTION 11/6/79

Anderson-Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIST. PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA.

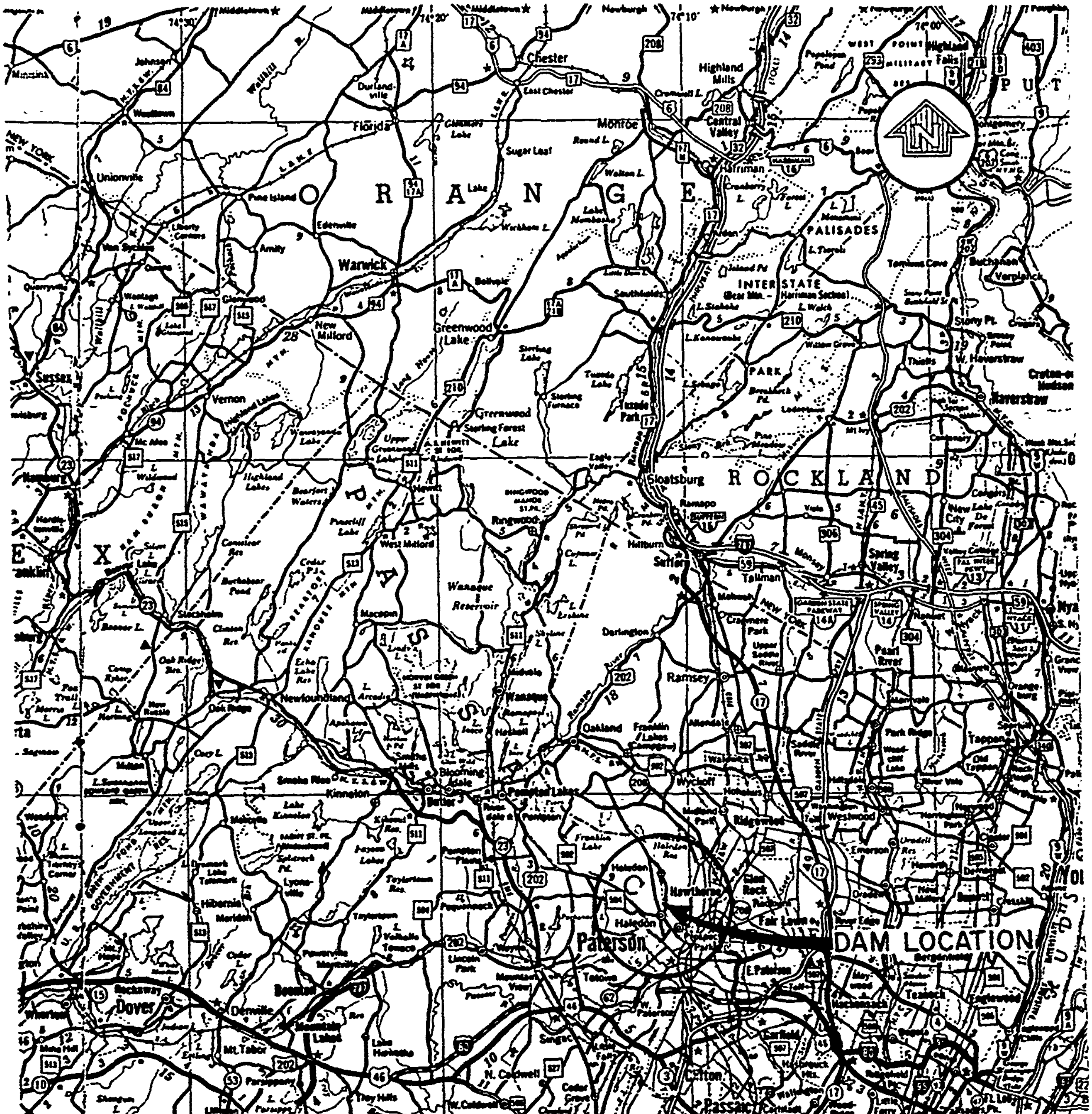
NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

OLDHAM POND DAM

MOLLY ANN BROOK — NEW JERSEY

			SCALE: NOT TO SCALE
			DATE: JANUARY 1980

FIGURE 2



Anderson–Nichols & Co., Inc. CONCORD NEW HAMPSHIRE	U.S. ARMY ENGINEER DIST. PHILADELPHIA CORPS OF ENGINEERS PHILADELPHIA, PA.

NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

OLDHAM POND DAM LOCATION MAP

SCALE IN MILES

0 5 10

MAP BASED ON STATE OF NEW JERSEY OFFICIAL HIGHWAY MAP AND GUIDE.

MOLLY ANN BROOK NEW JERSEY

SCALE: SEE BAR SCALE

DATE. JANUARY 1980

FIGURE 3

APPENDIX I

VISUAL INSPECTION CHECKLIST

OLDHAM POND DAM

Check List
Visual Inspection
Phase 1

Name Dam Oldham Pond Dam County PASSIC State NJ Coordinators NJDEP

Date(s) Inspection Nov. 7, 1979 Weather cool, cloudy Temperature 55 degrees F

Pool Elevation at Time of Inspection 202 NGVD Tailwater at Time of Inspection 190.7 NGVD

Inspection Personnel:

Warren Guinam	Ronald Hirschfeld
Stephen Gilman	
Kenneth Stuart	

R. Hirschfeld, S. Gilman Recorder

UNGATED SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good condition-minor surface erosion of laitances. Some spalling and erosion of abutments where in contact with the water. Downstream easterly training wall undermined at contact with concrete apron.	Repair undermining at all walls. Monitor erosion of spillway surface.
APPROACH CHANNEL	East side is concrete training wall. West side is unobstructed.	
DISCHARGE CHANNEL	Discharge from principal spillway via concrete inclined spillway chute and then into open channel. Training wall undermined and stone masonry wall d/s has stone missing.	Repair undermining at wall and stone masonry wall.
BRIDGE AND PIERS OVER SPILLWAY	None	

Sheet 1

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SEEPAGE OR LEAKAGE	West Emergency Spillway-Minor leakage along joint of concrete ogee. Center Emergency Spillway-Minor leakage at masonry joints and underneath masonry downstream wall.	Repair the horizontal construction joints in west emergency spillway face. Investigate minor leakage through foundation.
STRUCTURE TO ABUTMENT/EMBANKMENT JUNCTIONS	See Sheet 2 of " Embankment Dams"	
DRAINS	Center Emergency Spillway-None observed West Emergency Spillway-None observed	
WATER PASSAGES	Center Emergency Spillway-None Observed West Emergency Spillway-None Observed	
FOUNDATION	Center Emergency Spillway-Foundation not visible West Emergency Spillway-Foundation not visible	

CONCRETE/MASONRY DAMS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS CONCRETE SURFACES	West emergency spillway - good condition. Horizontal construction joint has efflorescence and evidence of seepage. Center emergency spillway - good. No indication of deterioration of crest or abutment.	Repair and seal construction joint.
STRUCTURAL CRACKING	West emergency spillway - none observed. Center emergency spillway - none observed.	
VERTICAL AND HORIZONTAL ALIGNMENT	West emergency spillway - good, no indication of movement. Center emergency spillway - good, no indication of movement.	
MONOLITH JOINTS	Not applicable.	
CONSTRUCTION JOINTS	West emergency spillway - hairline separation of joint between new concrete and old masonry structure	No action required.
	Center emergency spillway - hairline separation of joints between concrete and old masonry structure	No action required.

EMBANKMENT
WITH UPSTREAM CONCRETE-CAPPED AND FACED STONE-MASONRY WALL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SURFACE CRACKS	None observed. Sinkhole filled with concrete at break in alignment of upstream wall. Wall cracked at location of sinkhole	Repair wall and sinkhole
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	None observed	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	Brush cover on downstream slope makes it impossible to inspect it adequately	Remove brush and conduct inspection of slope
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Surface of crest is quite uneven. Horizontal alignment is good.	
RIPRAP FAILURES	No riprap	Provide upstream slope protection

EMBANKMENT

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
RAILINGS	No Railings	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Erosion at left side of west emergency spillway. Erosion of left and right sides of center emergency spillway.	
ANY NOTICEABLE SEEPAGE	None observed	
STAFF GAGE AND RECORDER	None observed	
DRAINS	None observed	
UPSTREAM WALLS	Concrete capped and faced stone masonry wall shows numerous areas of spalling and erosion on top of wall and upstream face. Substantial cracking and chipping of mortar between stone masonry. Numerous vertical cracks in wall. No indication of movement except at break in wall upstream at east abutment to center emergency spillway. Construction joint separated by approximately ½ inch	Engage an Engineer to design and inspect repairs to concrete wall . Construct repairs to concrete upstream wall.

UNGATED SPILLWAY
CENTER EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Good condition-"fabriform" mattress in good condition. Training walls recently (1975) rebuilt and in good condition	No action required
APPROACH CHANNEL	Wide and unobstructed	No action required
DISCHARGE CHANNEL	Open channel	No action required
BRIDGE AND PIERS OVER SPILLWAY	None	No action required

UNGATED SPILLWAY
WEST EMERGENCY SPILLWAY

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONCRETE WEIR	Ogee spillway and associated training walls in good condition.	No action required
APPROACH CHANNEL	Wide and unobstructed	No action required
DISCHARGE CHANNEL	Open Channel	No action required
BRIDGE AND PIERS OVER SPILLWAY	None	No action required

OUTLET WORKS

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CRACKING AND SPALLING OF CONCRETE SURFACES IN OUTLET CONDUIT	Visible portion of outlet has surface erosion and some spalling	Make detailed inspection of outlet conduit and perform necessary repairs at deteriorated concrete
INTAKE STRUCTURE	Not visible	
OUTLET PIPE	Opening covered with brush and partially sedimented	Remove brush and debris from the outlet pipe opening
OUTLET CHANNEL	Trees and brush growing in outlet channel and overhanging the outlet channel	Remove brush and trees from the outlet channel for 25 ft. on either side of the channel for a distance downstream of dam sufficient to prevent reduction of spillway capacity by fallen trees.
EMERGENCY GATE	Access door visible, valving mechanism not inspected	

INSTRUMENTATION

VISUAL EXAMINATION	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
MONUMENTATION/SURVEYS	None apparent	
OBSERVATION WELLS	None apparent	
WEIRS	None apparent	
PIEZOMETERS	None apparent	
OTHER	None apparent	

RESERVOIR

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
SLOPES	Gently to moderately sloping and heavily urbanized	
SEDIMENTATION	No evidence of significant sediment was observed	

DOWNSTREAM CHANNEL

VISUAL EXAMINATION OF	OBSERVATIONS	REMARKS OR RECOMMENDATIONS
CONDITION (OBST.UCTIONS, DEBRIS, ETC.)	Trees and brush growing in discharge channel and considerable debris	Clear trees and brush on either side of the discharge channel and for a distance downstream of the dam
SLOPES	Deep stream channel with wide flat overbanks	
APPROXIMATE NO. OF HOMES AND POPULATION	15 houses with an estimated population of 45 people	

CHECK LIST
ENGINEERING DATA
DESIGN, CONSTRUCTION, OPERATION

ITEM	REMARKS
PLAN OF DAM	Plan of dam shown in Figure 1 from visual inspection on 6 November 1979 and Plans by Justin & Courtney May 1961 and Riparian and Stream Survey, WPA New Jersey undated.
REGIONAL VICINITY MAP	Prepared for this report
CONSTRUCTION HISTORY	Original dam construction date between 1834 and 1875. Further discussion in text Section 1.2g and Section 6.4
TYPICAL SECTIONS OF DAM	See "Plan of Dam" above
HYDROLOGIC/HYDRAULIC DATA	No original data were disclosed
OUTLETS - PLAN	None disclosed
- DETAILS	None disclosed
- CONSTRAINTS	None disclosed
- DISCHARGE RATINGS	None disclosed
RAINFALL/RESERVOIR RECORDS	None disclosed

ITEM	REMARKS
DESIGN REPORTS	A design report for the rebuilding of West Emergency Spillway was disclosed. The consulting engineer was Justin & Courtney of Philadelphia with construction from August 21 to November 20, 1963.
GEOLOGY REPORTS	None disclosed
DESIGN COMPUTATIONS HYDROLOGY & HYDRAULICS DAM STABILITY SEEPAGE STUDIES	None disclosed
MATERIALS INVESTIGATIONS BORING RECORDS LABORATORY FIELD	None disclosed
POST-CONSTRUCTION SURVEYS OF DAM	Justin & Courtney of Philadelphia May 1961 WPA Riparian & Stream Survey undated
BORROW SOURCES	Unknown

ITEM	REMARKS
MONITORING SERVICES	Unknown
MODIFICATIONS	Several modifications to original dam as discussed in Section 1.2a, Section 1.2g, Section 6.4
HIGH POOL RECORDS	Flood run-off estimates for 23 July 1945 accompany "Report on Dam Application" dated 18 September 1945
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	Several inspections were performed on Oldham Pond Dam as documented in Section 5.1b and Appendix 4
PRIOR ACCIDENTS OR FAILURE OF DAM DESCRIPTION REPORTS	Slight overtopping was noted during 23 July 1945 flood as discussed in Section 5.1,b and spillway wash outs as a result of high water are referenced in Appendix 4
MAINTENANCE OPERATION RECORDS	None revealed

ITEM	REMARKS
SPILLWAY PLAN	No original plans were revealed.
SECTIONS DETAILS	Typical section of spillway was developed for this report from visual inspection on 6 Nov. 1979 and Plans by Justin & Courtney May 1931, and Riparian and Stream Survey, WPA New Jersey undated.
OPERATING EQUIPMENT PLANS & DETAILS	The 12" factory intake line has an operating valve. The low level outlet mechanism valve has been operated at irregular intervals. Typical section of spillways were developed for this report from visual inspection on 6 Nov. 1979 and Plans by Justin & Courtney May 1931, and Riparian and Stream Survey, WPA New Jersey undated.

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA

DRAINAGE AREA CHARACTERISTICS: 5.3 square miles, gently to steeply sloping and heavily urbanized

ELEVATION TOP NORMAL POOL (STORAGE CAPACITY): 202.7 NGVD (77 acre-feet)

ELEVATION TOP FLOOD CONTROL POOL (STORAGE CAPACITY): 206.7 NGVD (153 acre-ft)

ELEVATION MAXIMUM DESIGN POOL: 210.53 NGVD (PMF)

ELEVATION TOP DAM: 206.7 (NGVD)

PRINCIPAL SPILLWAY CREST: Free overflow flat crested concrete capped

a. Elevation: 202.7 (NGVD

b. Type Concrete weir

c. Length 39 feet

d. Width 3 feet

e. Location Spillover Adjacent to east abutment

f. Number and Type of Gates none

CENTER EMERGENCY SPILLWAY CREST: Free overflow broad crested "fabriform" concrete mattress capped

a. Elevation 203.7 (NGVD)

b. Type Concrete "fabriform" weir

c. Length 100 feet

d. Width 40 feet

e. Location Spillover: Centered between east and west abutment

f. Number and Type of Gates: None

EMERGENCY SPILLWAY WEST CREST: Free overflow concrete ogee

a. Elevation 203.7 (NGVD)

b. Type Concrete weir

c. Length 56 feet

d. Width 1.5 feet

e. Location Spillover 650 feet west of east abutment

f. Number and Type of Gates None

CHECK LIST
HYDROLOGIC AND HYDRAULIC DATA
ENGINEERING DATA
(CONTINUED)

OUTLET WORKS: Low level outlet

a. Type 2.5 feet by 3.0 feet box culvert

b. Location 350 feet west of east abutment

c. Entrance Inver+s Unknown

d. Exit Inverts 190.7 NGVD

e. Emergency Draindown Facilities Described above

HYDROMETEORLOGICAL GAGES: None disclosed

a. Type

b. Location

c. Records

MAXIMUM NON-DAMAGING DISCHARGE: 3179 cfs

APPENDIX 2

PHOTOGRAPHS

OLDHAM POND DAM

7 NOVEMBER 1979
VIEW LOOKING EAST FROM EAST TRAINING WALL OF WEST EMERGENCY SPILLWAY TOWARD EAST DAM ABUTMENT.

7 NOVEMBER 1979
VIEW LOOKING WEST FROM EAST TRAINING WALL OF WEST EMERGENCY SPILLWAY TOWARD WEST DAM ABMUTMENT. NOTE SMALL WOODEN STRUCTURE ADJACENT TO WEST ABUTMENT WHICH HOUSES THE CONTROL MECHANISM FOR THE FACTORY INTAKE LINE.

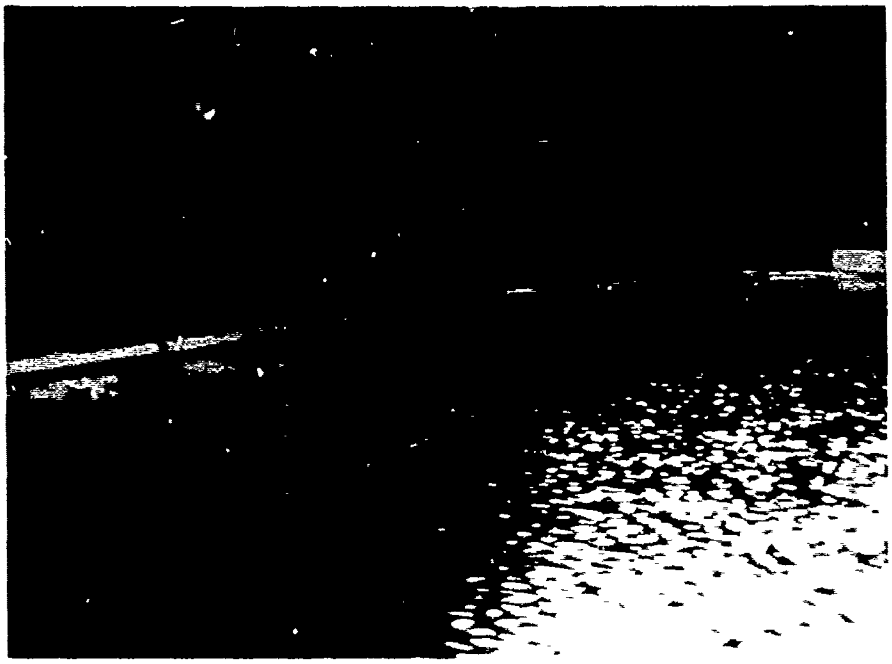
OLDHAM POND DAM

7 NOVEMBER 1979
VIEW FROM WEST TRAINING WALL OF WEST EMERGENCY SPILLWAY SHOWING SPILLWAY AND HEAVY VEGETATION ON DAM EMBANKMENT. VIEW IS LOOKING EAST.

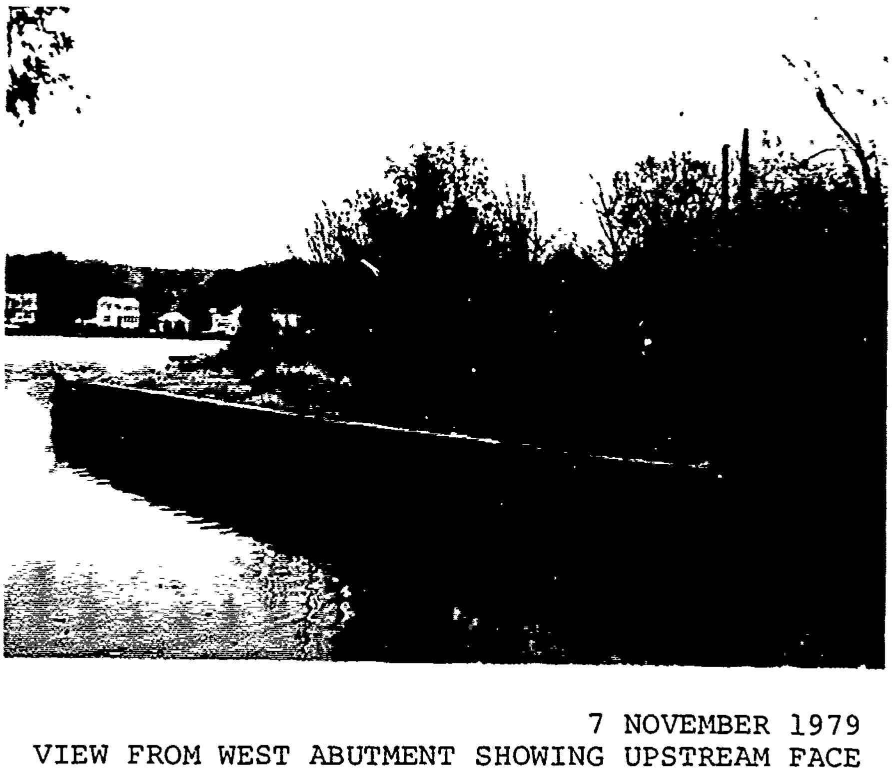
7 NOVEMBER 1979
VIEW FROM WEST TRAINING WALL OF CENTER EMERGENCY SPILLWAY SHOWING "FABRIFORM" CONCRETE MATTRESS SPILLWAY CREST AND RECENTLY REBUILT TRAINING WALL. VIEW IS LOOKING EAST.

7 NOVEMBER 1979
VIEW FROM WEST TRAINING WALL OF PRINCIPAL SPILLWAY LOOKING AT EAST ABUTMENT TRAINING WALL. CHURCH STREET, SEEN IN THE BACKGROUND, RUNS ALONG THE EAST SIDE OF OLDHAM POND.

7 NOVEMBER 1979
VIEW FROM WEST TRAINING WALL OF PRINCIPAL SPILLWAY LOOKING AT DISCHARGE CHANNEL AND EROSION AREA DOWNSTREAM. CHURCH STREET IS SEEN IN BACKGROUND.

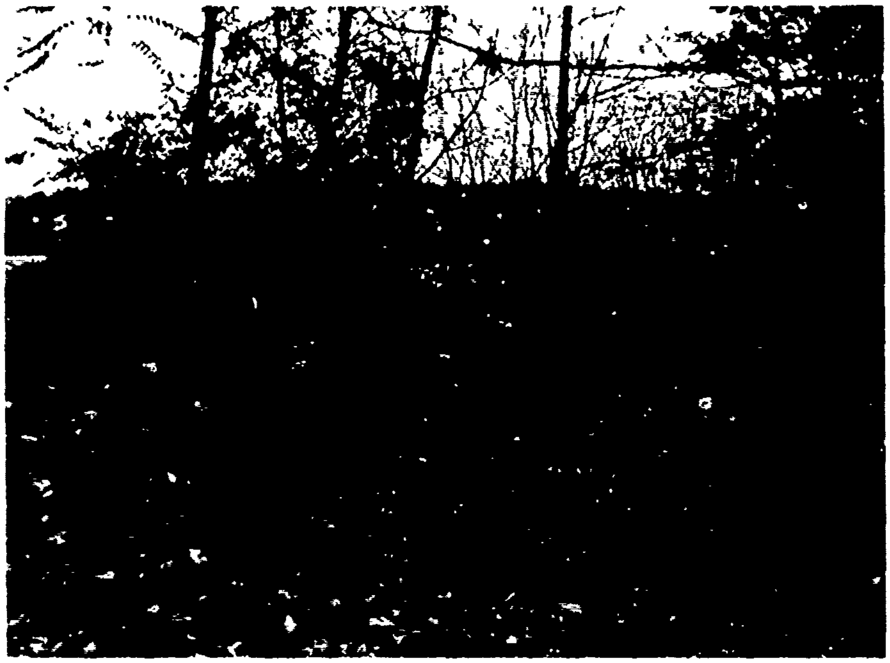


7 NOVEMBER 1979
VIEW OF UPSTREAM FACE OF DAM.



7 NOVEMBER 1979
VIEW FROM WEST ABUTMENT SHOWING UPSTREAM FACE OF DAM AND HEAVY VEGETATION ON THE EMBANKMENT.

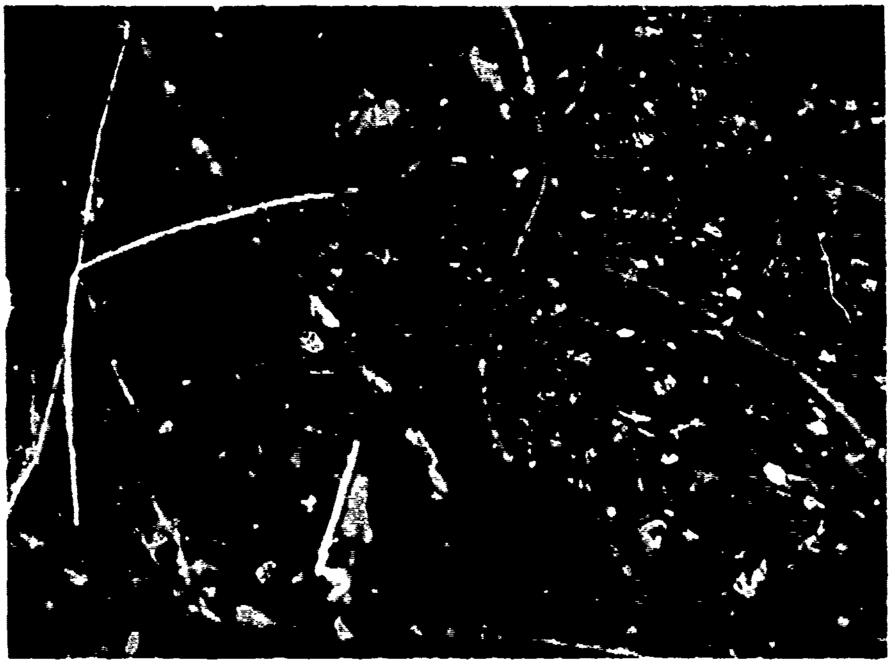
OLDHAM POND DAM



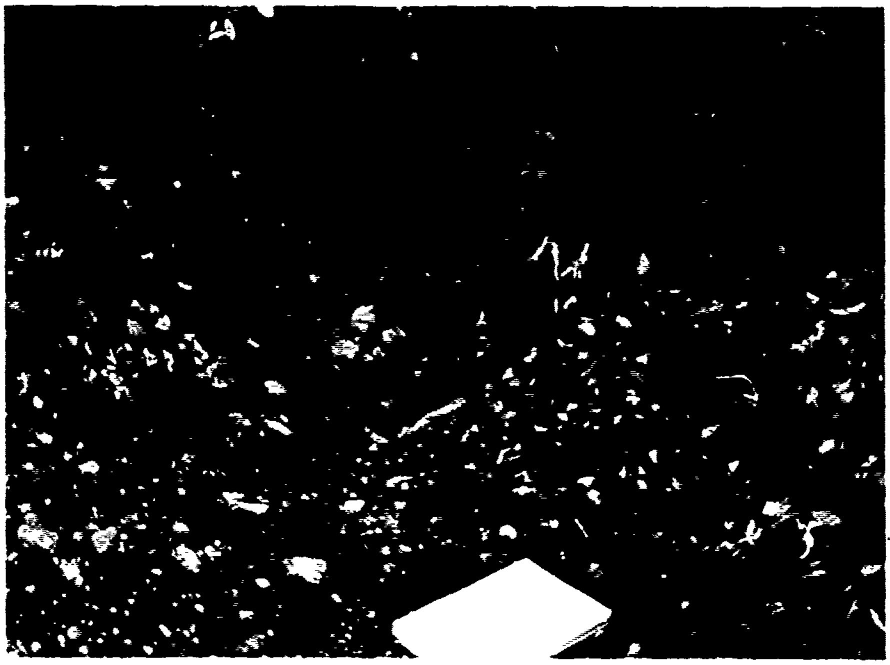
7 NOVEMBER 1979
DOWNSTREAM FACE OF EMBANKMENT.

7 NOVEMBER 1979
ACCESS DOOR TO LOW-LEVEL OUTLET VALVING MECHANISM.

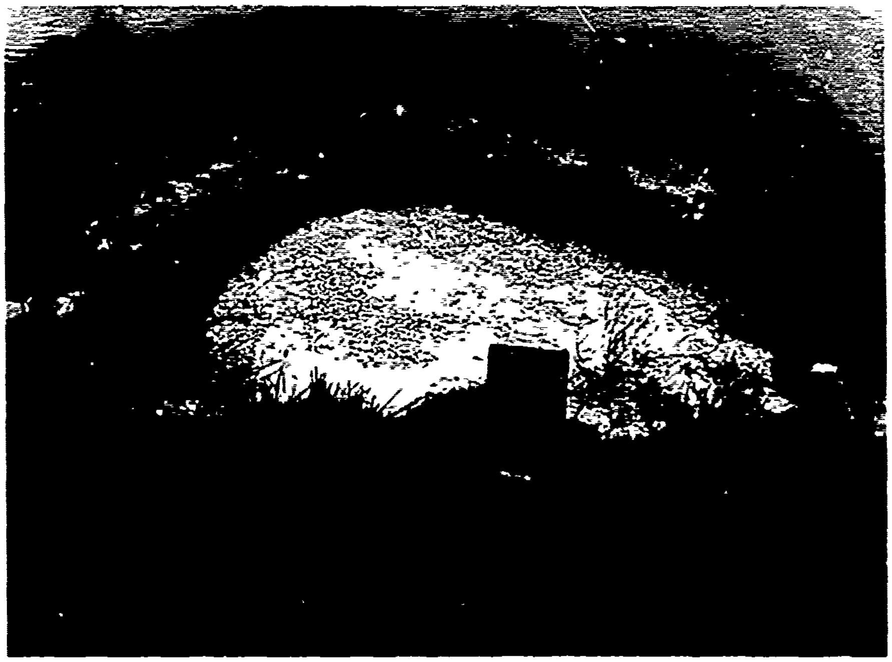
OLDHAM POND DAM



7 NOVEMBER 1979
DOWNSTREAM AREA OF LOW-LEVEL OUTLET.



7 NOVEMBER 1979
VIEW FROM DAM CREST SHOWING ERODED PATHWAY ON WESTERLY SIDE OF THE PRINCIPAL SPILLWAY.

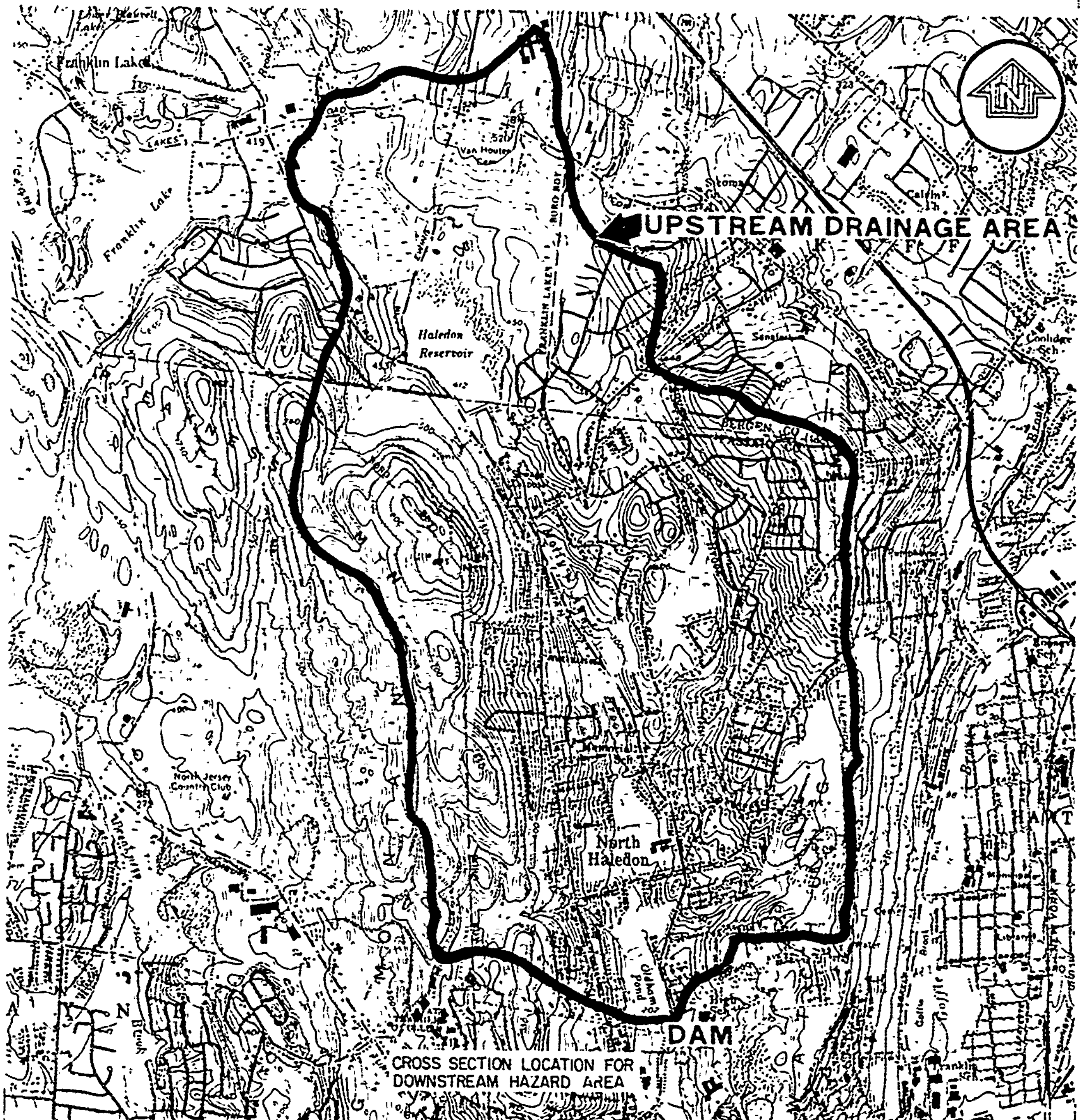


7 NOVEMBER 1979
VIEW OF WEST TRAINING WALL OF PRINCIPAL SPILLWAY IN AREA WHERE SINKHOLE IN THE EMBANKMENT HAS BEEN FILLED WITH CONCRETE.

APPENDIX 3

HYDROLOGIC COMPUTATIONS

OLDHAM POND DAM



NATIONAL PROGRAM OF INSPECTION OF NON-FED. DAMS

OLDHAM POND DAM

NORTH HALEDON, NEW JERSEY

REGIONAL VICINITY MAP

JANUARY 1980

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
PHILADELPHIA, PENNSYLVANIA

ANDERSON-NICHOLS & CO., INC. CONCORD, N.H.

SCALE IN MILES

0 1/2

MAP BASED ON U.S.G.S. 7.5 MINUTE QUADRANGLE SHEET. PATERSON, N J. 1955. REVISED 1978

SQUARES 1/4" SCALE

HYDROLOGIC COMPUTATIONS

NAME: OLDHAM POND DAM

LOCATION: PASSAIC COUNTY, NJ

DRAINAGE AREA: 5.3 SQUARE MILES

SURFACE AREA: 17 ACRES

EVALUATION CRITERIA: SIZE: SMALL
HAZARD: HIGH

SPILLWAY DESIGN FLOOD: BASED ON SIZE AND HAZARD CLASSIFICATION
THE SPILLWAY DESIGN FLOOD WILL BE THE PMF
(PROBABLE MAXIMUM FLOOD) WITH A PEAK INFLOW
OF 14357 CFS.

SQUARES 1/4 SCALE

0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

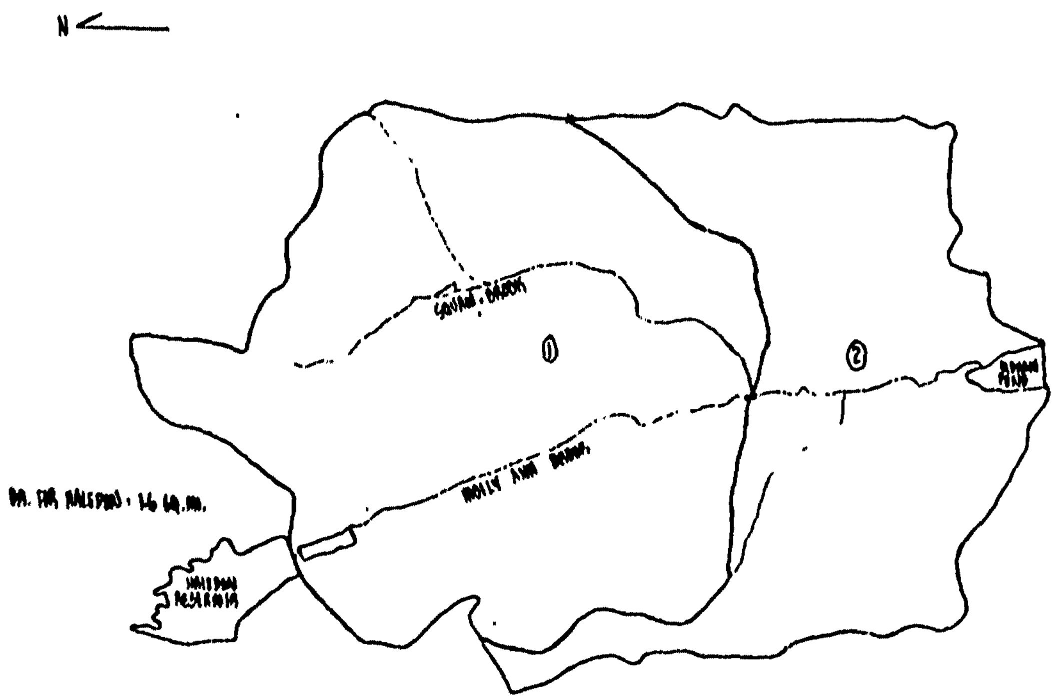
TIME OF CONCENTRATION

WITHIN THE OLDHAM POND DAM WATERSHED IS HALEDON RESERVOIR. HALEDON RESERVOIR SUB-WATERSHED OCCUPIES 1.6 SQUARE MILES OF THE TOTAL 5.3 SQUARE MILE WATERSHED. MOLLY ANN BROOK FLOWS OUT OF HALEDON RESERVOIR AND SQUAW BROOK JOINS IT BEFORE ENTERING OLDHAM POND. HALEDON RESERVOIR HAS HAD A PHASE I INSPECTION REPORT DONE FOR IT. THE HEC-1 RUN FOR OLDHAM POND DAM USES HALEDON RESERVOIR LAG TIME, STORAGE-ELEVATION AND ELEVATION-DISCHARGE INFORMATION. RESULTING HYDROGRAPHS DIFFER SINCE THE OLDHAM POND DAM'S HEC-1 RUN USES A FIVE MINUTE TIME INCREMENT AND DELELOPS ITS OWN HYDROGRAPH. THE HALEDON RESERVOIR HEC-1 USED A TIME INCREMENT OF FIFTEEN MINUTES TO DEVELOP AND DIRECTLY INPUT THE UNIT HYDROGRAPH. THE OUTFLOW FROM HALEDON RESERVOIR WAS ROUTED TO THE MOLLY ANN BROOK AND SQUAW BROOK CONFLUENCE. AN INFLOW HYDROGRAPH WAS DEVELOPED FOR THE SUB-BASIN BETWEEN HALEDON RESERVOIR AND THE STREAM CONFLUENCE. A TIME OF CONCENTRATION WAS DEVELOPED FOR THIS AREA CALLED

SQUARES 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30
1/4" SCALE

TIME OF CONCENTRATION (CONT.)

SUB-BASIN 1. AT THE STREAM CONFLUENCE THE HALEDON RESERVOIR HYDROGRAPH AND THE SUB-BASIN 1 HYDROGRAPHS WERE COMBINED. THIS COMBINED HYDROGRAPH WAS ROUTED TO THE INLET OF OLDHAM POND DAM. A TIME OF CONCENTRATION WAS DEVELOPED FOR THIS AREA CALLED SUB-BASIN 2. THE ROUTED HALEDON RESERVOIR/SUB-BASIN 1 HYDROGRAPH IS COMBINED WITH THE HYDROGRAPH FROM SUB-BASIN 2. THIS COMBINED HYDROGRAPH IS ROUTED THROUGH OLDHAM POND AND OVER OLDHAM POND DAM. A CROSS SECTION REPRESENTATIVE OF THE DOWNSTREAM HAZARD AREA WAS INPUT AND THE OUTFLOW FROM OLDHAM POND DAM WAS ROUTED DOWNSTREAM.



P_A BASIN	P_A ①	P_A ②
25.90	15.61	10.10
25.76	15.64	10.03
25.89	15.67	10.14
25.82	15.66	10.09

CONVERSION FACTOR = 0.143480 sq mi / sq in.

AREA BASIN : 3.7 SQ.MI.

AREA SUB-BASIN ① : 2.3 SQ.MI.

AREA SUB-BASIN ② : 1.4 SQ.MI.

✓ 4/84

ANDERSON-NICHOLS

VERNON · BOSTON · CONCORD

OLDHAM POND DAM
DRAINAGE AREA

DATE	SCALE:	JOB NO.	SHEET NO.

TIME OF CONCENTRATION (CONT.)

SUB-BASIN 1 (SUB-BASIN IS AREA BETWEEN HALEDON RESERVOIR OUTLET AND MOLLY ANN BROOK AND SQUAW BROOK CONFLUENCE)

LENGTH OF OVERLAND FLOW = 3500'

ELEVATION DIFFERENCE FROM WATERSHED DIVIDE TO THE SQUAW BROOK STREAM THREAD = 230'

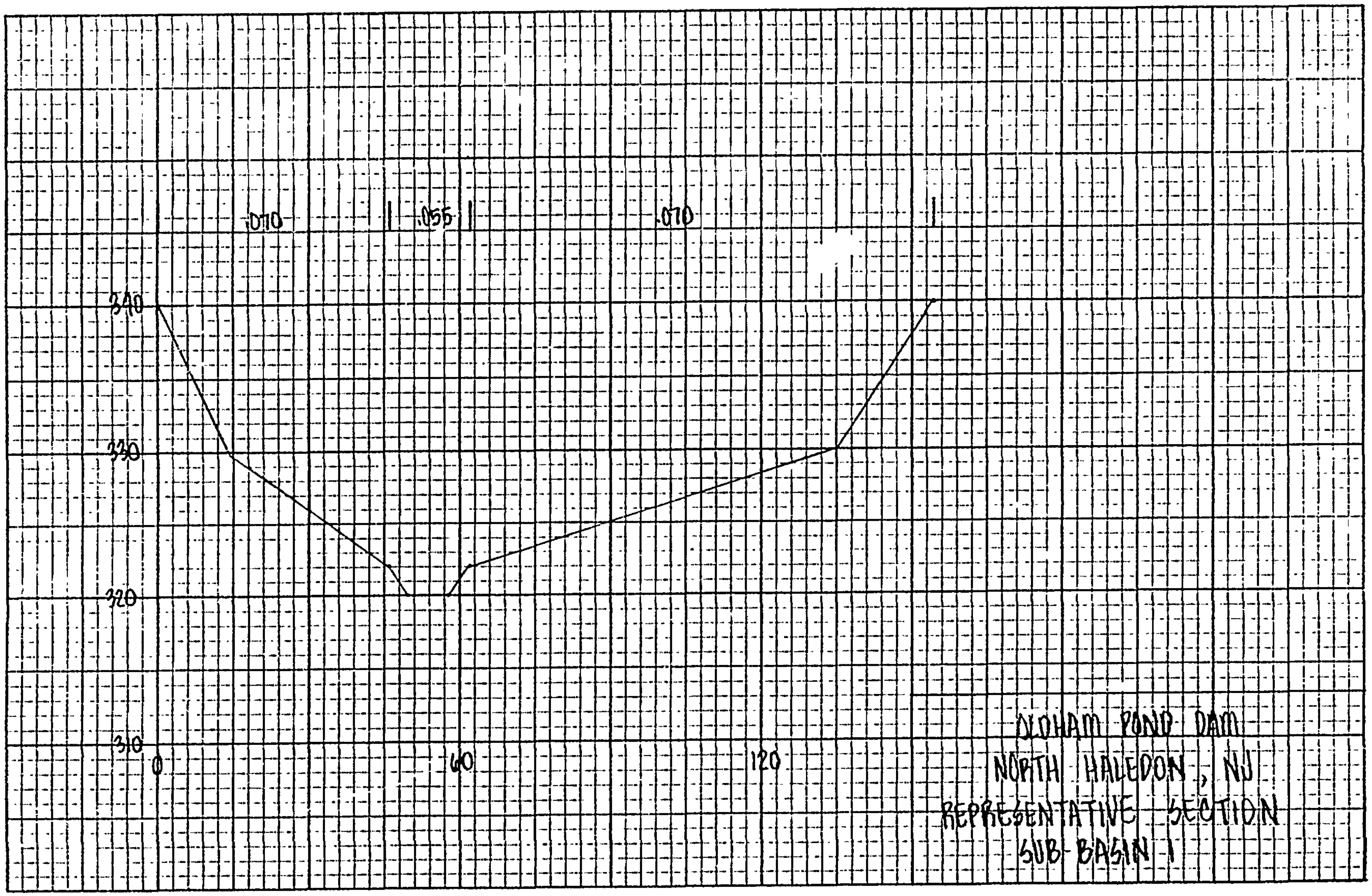
SLOPE FOR OVERLAND FLOW = 0.066 OR 6.6%

ALSO

LENGTH OF STREAMFLOW (SQUAW BROOK) FROM THE END OF OVERLAND FLOW TO CONFLUENCE WITH MOLLY ANN BROOK = 5800'

ELEVATION DIFFERENCE FROM END OF OVERLAND FLOW TO CONFLUENCE = 18'

SLOPE FOR SQUAW BROOK = 0.019 = 1.9%


.070
.055
.070
340
330
320
310
0
60
120
OLDHAM POND DAM
NORTH HALEDON, NJ
REPRESENTATIVE SECTION
SUB-BASIN 1

Anderson-Nichols & Company, Inc. Subject H&H Sheet No. 5 of 17
Date 12/79
JOB NO. 3409-08 OLDHAM POND DAM Computed DJB
Checked EDD

SQUARES 1/4 SCALE 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

TIME OF CONCENTRATION (CONT.)

ALSO

THE REPRESENTATIVE CROSS SECTION FOR SUB BASIN I WAS DRAWN TO DETERMINE AN APPROXIMATE STREAMFLOW VELOCITY AT A WATER DEPTH OF 6'.

AREA FOR CROSS SECTION = 243 SQ.FT.

WETTED PERIMETER = 74.2 FT.

HYDRAULIC RADIUS = 3.3 FT.

CHANNEL "N" = .055

OVERBANK "N" = .075

$$V = \frac{1.49}{n} (R)^{2/3} (S)^{1/2}$$

$$V = 8.3 \text{ fps}$$

THE TIME OF CONCENTRATION FOR STREAMFLOW OF SQUAW BROOK EQUALS $\frac{5800'}{8.3(60)} = 11.6$ MINUTES

SQUARES 1/4 SCALE

TIME OF CONCENTRATION (CONT.)

FOUR METHODS FOR DETERMINING T_c ARE AVERAGED

WESTON

$L = 3500'$

$S = 6.6\%$

$V \approx 1.8$ fps

$$\frac{3500}{1.8(60)} = 32.4 \text{ MIN. FOR } T_c \text{ OVERLAND} + 11.6 \text{ STREAMFLOW}$$

$T_c = 44$ MINUTES

KERBY

$$T_c = 0.83 \left(\frac{NL}{\sqrt{S}}\right)^{0.467}$$

$$T_c = 0.83 \left(\frac{.1(3500)}{\sqrt{.066}}\right)^{.467} = 24.1 \text{ MIN. FOR } T_c \text{ OVERLAND} +$$

11.6 MIN STREAMFLOW

$T_c = 35.7$ MINUTES

TIME OF CONCENTRATION (CONT.)

DESIGN OF SMALL DAMS

USING TEXAS HIGHWAY CHARTS FOR VELOCITIES:

CHANNEL VELOCITY $\simeq$ 3.0 fps

OVERLAND VELOCITY = 3.0 fps

$L_0 = 5800 \qquad L_s = 3500$

$$T_c = \frac{5800 + 3500}{3} = 3100 \text{ sec.}$$

$$T_c = 51.7 \text{ MIN.}$$

SOIL & WATER CONSERVATION ENGINEERING

$$T_{LAG} = \frac{l^{0.8}\,(s+1)^{1.67}}{9000\ Y^{0.5}}$$

WHERE : $s = \frac{1000}{N} - 10 \qquad N = 80$

$$Y = \frac{350}{9300} = .038 = 3.8\%$$

$$T_L = \frac{9300^{.8}\,(2.5)^{1.67}}{9000\,(3.8)^{.5}} = 0.39 \text{ HR}, \quad T_c = 1.67\,(T_L)$$

$$T_c = 39 \text{ MIN}$$

Anderson-Nichols & Company, Inc.

JOB NO. 3409-08

Subject H&H

OLDHAM POND DAM

Sheet No. 8 of 17
Date 12/79
Computed KJS
Checked FDD

SQUARES 1/4 SCALE

TIME OF CONCENTRATION (CONT.)

AVERAGE T_C FOR SUB-BASIN 1 = 43 MIN.

T_L (LAG) FOR SUB-BASIN 1 = 26 MIN = 0.4 HRS.

SUB-BASIN 2 (SUB-BASIN IS AREA BETWEEN MOLLY ANN BROOK AND SQUAW BROOK CONFLUENCE TO OLDHAM POND DAM)

LENGTH OF OVERLAND FLOW = 4000'

ELEVATION DIFFERENCE FROM WATERSHED DIVIDE TO MOLLY ANN BROOK STREAM THREAD = 450'

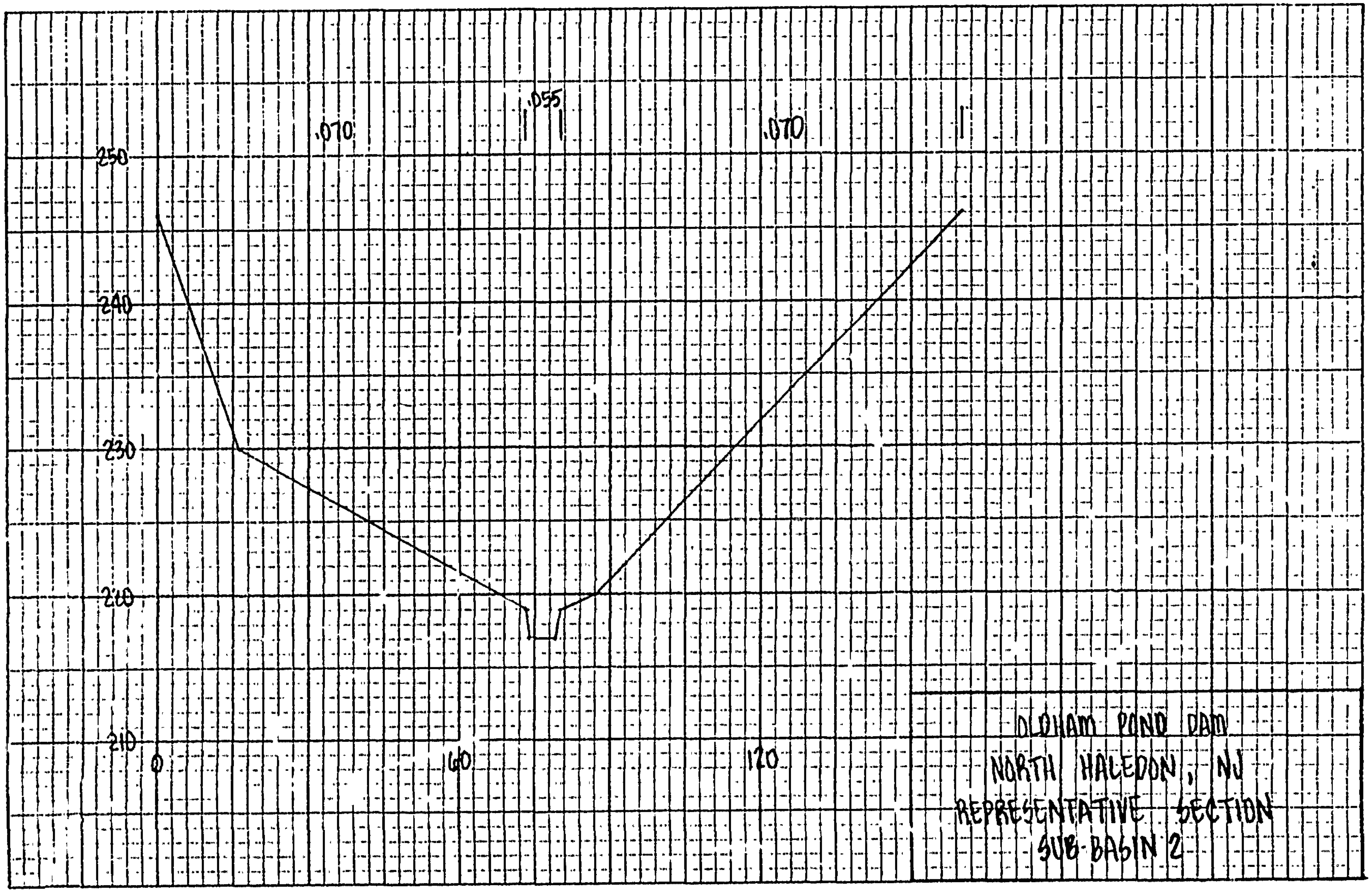
SLOPE FOR OVERLAND FLOW = .113 = 11.3%

ALSO

LENGTH OF STREAMFLOW (MOLLY ANN BROOK) FROM THE END OF OVERLAND FLOW TO THE INLET OF OLDHAM POND. = 2400'

ELEVATION DIFFERENCE FROM END OF OVERLAND FLOW TO THE INLET = 18'

SLOPE FOR THIS SECTION OF MOLLY ANN BROOK = .0075 = .75%


.070
.055
.070
250
240
230
220
210
0
60
120
OLDHAM POND DAM
NORTH HALEDON, NJ
REPRESENTATIVE SECTION
SUB-BASIN 2

Anderson-Nichols & Company, Inc.

JOB NO. 3409-08

Subject H&H

OLDHAM POND DAM

Sheet No. 9 of 17
Date 12/79
Computed KJS
Checked DD

TIME OF CONCENTRATION (CONT.)

ALSO

THE REPRESENTATIVE CROSS SECTION FOR SUB-BASIN 2 WAS DRAWN TO DETERMINE AN APPROXIMATE STREAMFLOW VELOCITY AT A WATER DEPTH OF 6'.

AREA FOR CROSS SECTION = 122.3 SQ. FT.

WETTED PERIMETER = 39.8 FT.

HYDRAULIC RADIUS = 3.1 FT.

CHANNEL "N" = .055

OVERBANK "N" = .075

$$V = \frac{1.49}{N}(R)^{2/3}(S)^{1/2} \qquad V = 5.0 \text{ fps}$$

THE TIME OF CONCENTRATION FOR STREAMFLOW OF MOLLY ANN BROOK EQUALS $\dfrac{2400'}{(5)(60)} = 8$ MINUTES

Anderson-Nichols & Company, Inc.

Subject H&H

JOB NO. 3409-08

OLDHAM POND DAM

Date 12/78

Computed KJS

Checked FDD

TIME OF CONCENTRATION (CONT.)

FOUR METHODS FOR DETERMINING T_c ARE AVERAGED

WESTON

$L = 4000'$

$S = 11.3\%$

$V = 2.2$ fps

$\frac{4000}{2.2(60)} = 30.3$ MIN. FOR T_c OVERLAND + 8.0 STREAMFLOW

$T_c = 38$ MIN.

KERBY

$$T_c = 0.83 \left(\frac{NL}{\sqrt{S}}\right)^{.467}$$

$$T_c = 0.83 \left(\frac{.1(4000)}{\sqrt{.113}}\right)^{.467}$$ = 22.7 MIN. FOR T_c OVERLAND +

8.0 MIN. STREAMFLOW

$T_c = 30.7$ MIN.

SQUARES 1/4" SCALE

TIME OF CONCENTRATION (CONT.)

DESIGN OF SMALL DAMS

USING TEXAS HIGHWAY CHARTS FOR VELOCITIES:

CHANNEL VELOCITY = 3.0 fps

OVERBANK VELOCITY = 3.0 fps

$L_o = 2400'$ $\quad L_s = 4000$

$$T_c = \frac{2400 + 4000}{3} = 2133 \text{ SEC}$$

$T_c = 35.6$ MIN.

SOIL & WATER CONSERVATION ENGINEERING

$$T_{LAG} = \frac{l^{0.8}(s+1)^{1.67}}{9000\, Y^{0.5}}$$

WHERE $s = \frac{1000}{N} - 10 \qquad N = 80$

$$Y = \frac{468}{6400} = .073 = 7.3\%$$

$$T_L = \frac{6400^{.8}(2.5)^{1.67}}{9000\,(7.3)^{.5}} = .37 \text{ HRS}, \; T_c = 1.67(T_L)$$

$T_c = 37$ MIN.

OLDHAM POND DAM

SQUARES 1/4" SCALE

TIME OF CONCENTRATION (CONT.)

AVERAGE T_C FOR SUB-BASIN 2 = 35 MIN.

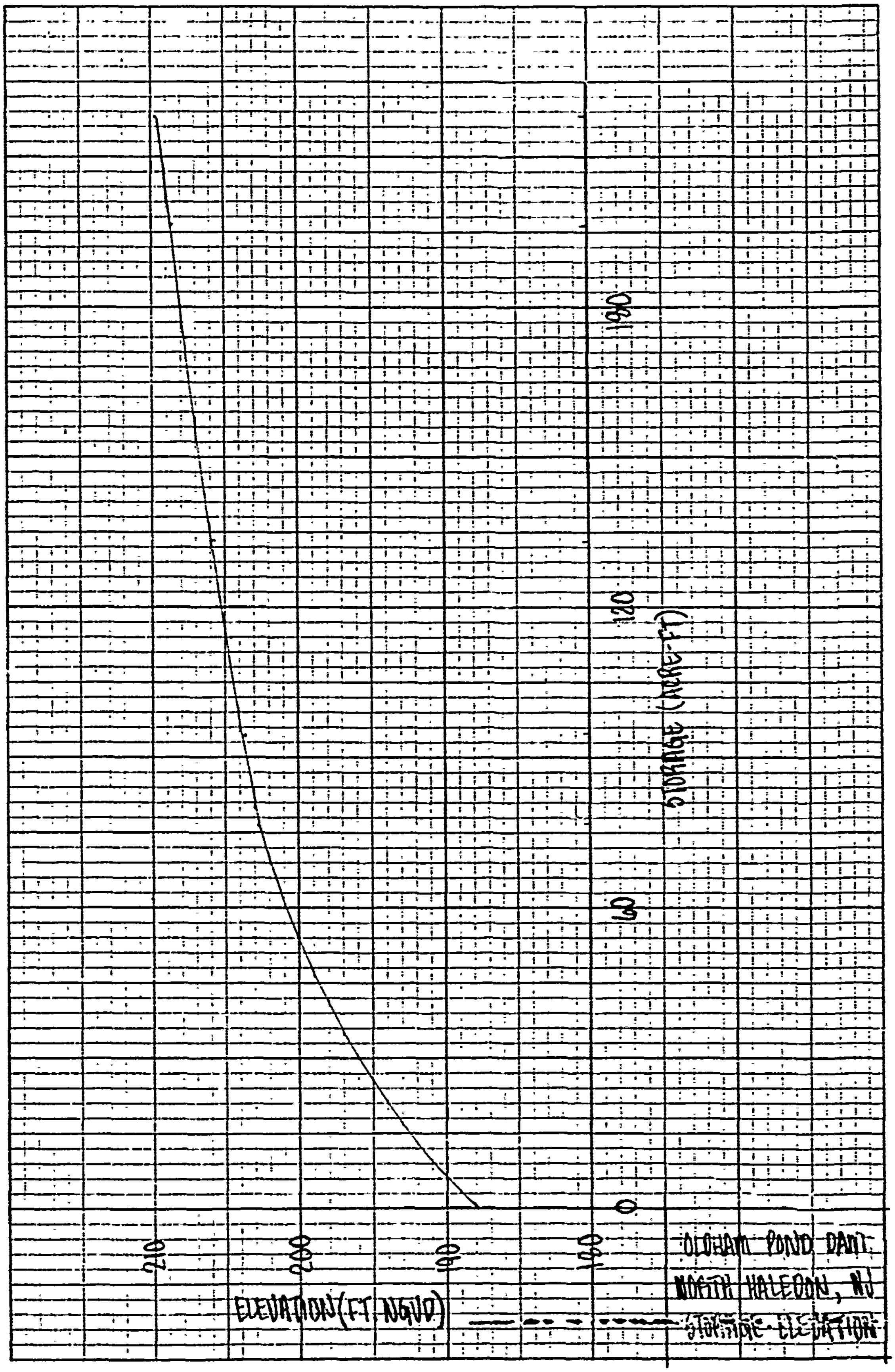
T_L (LAG) FOR SUB-BASIN 2 = 21 MIN. = 0.3 HRS.

STORAGE-ELEVATION DETERMINATIONS

ELEVATION FT.	HEAD FT.	AREA ACRES	AVG. AREA ACRES	STORAGE ACRE-FEET
202.7	0	17.5		77
			17.9	
203.7	1	18.3		95
			18.7	
204.7	2	19.0		114
			19.4	
205.7	3	19.8		133
			20.2	
206.7	4	20.5		153
			20.9	
207.7	5	21.2		174
			21.6	
208.7	6	22.0		196
			22.4	
209.7	7	22.7		218

13/17

COMPUTED: KJS
CHKD: FDD



Anderson-Nichols & Company, Inc.

Subject H & H

Sheet No. 14 of 17
Date 12/79
Computed KJS
Checked FDD

JOB NO. 3409-08

OLDHAM POND DAM

SPILLWAYS CAPACITIES

OLDHAM POND DAM HAS THREE SPILLWAYS. THE PRINCIPAL SPILLWAY AND TWO EMERGENCY SPILLWAYS. SPILLWAY CAPACITES WERE DETERMINED USING THE WEIR EQUATION ($Q = CLH^{3/2}$). C VALUES FOR THE SPILLWAYS WERE TAKEN FROM AN ANALYSIS DATED 15 JULY 1963 BY JUSTIN & COURTNEY OF PHILADELPHIA.

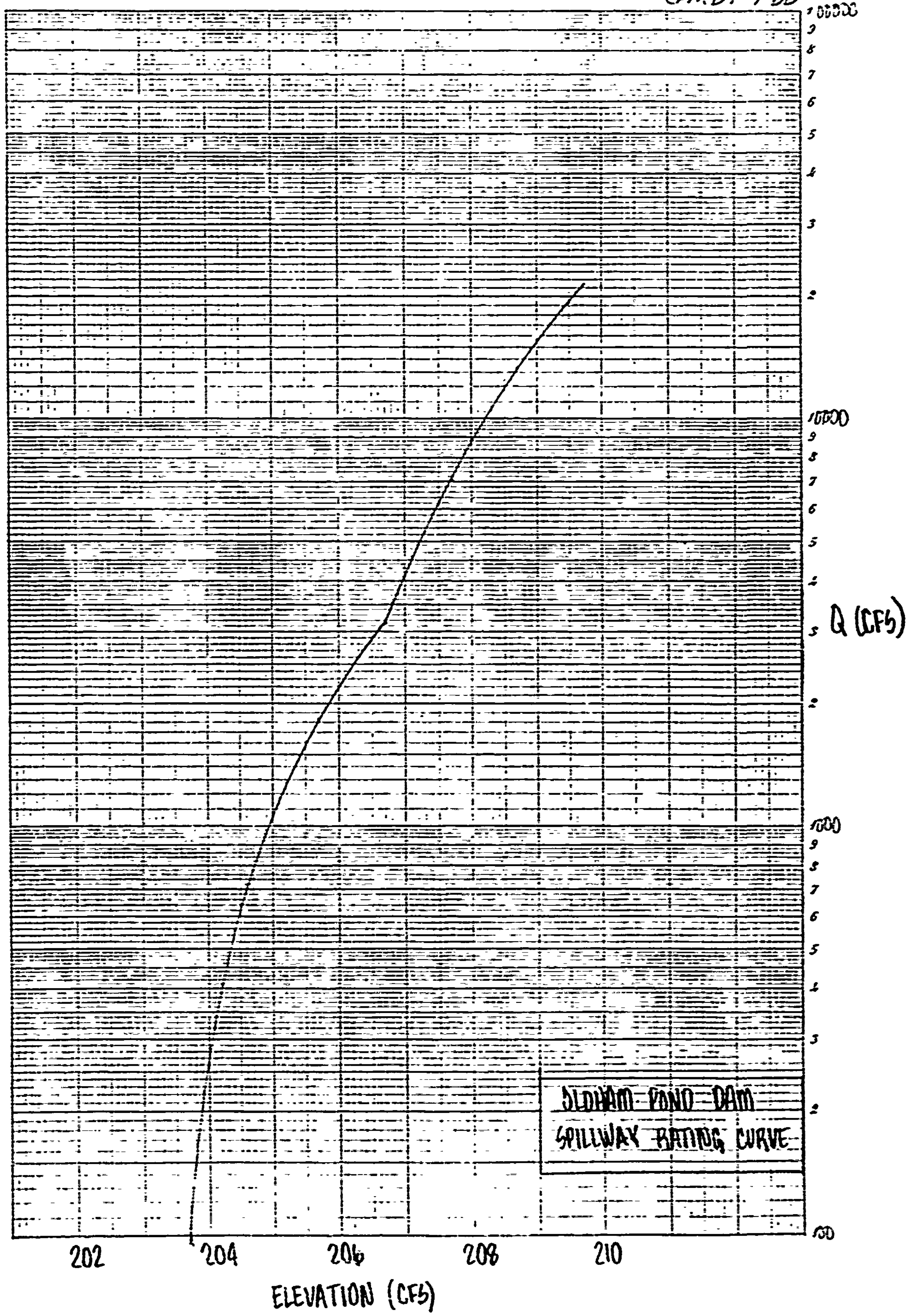
ELEVATION NGVD	PRINCIPAL SPILL.			CENTER EMER. SPILL.			WEST EMER. SPILL.			OVER DAM				TOTAL
	H	C	Q	H	C	Q	H	C	Q	H	L	C	Q	Q
202.7	0	2.65	0											0
203.7	1	2.65	103	0	2.65	0	0	3.35	0					103
204.7	2	2.65	292	1	2.65	265	1	3.35	188					745
205.7	3	2.65	537	2	2.65	750	2	3.35	531					1818
206.7	4	2.65	827	3	2.65	1377	3	3.35	975	0				3179
207.7	5	2.65	1155	4	2.65	2120	4	3.35	1501	1	900	2.5	2250	7026
208.7	6	2.65	1519	5	2.65	2963	5	3.35	2097	2	950	2.5	6718	13297
209.7	7	2.65	1914	6	2.65	3895	6	3.35	2757	3	960	2.5	12471	21037

PRINCIPAL SPILLWAY : L = 39 FT.

CENTER EMERGENCY SPILLWAY : L = 100 FT

WEST EMERGENCY SPILLWAY : L = 56 FT.

15/17
COMPUTED: KJS
CHKD: FDD



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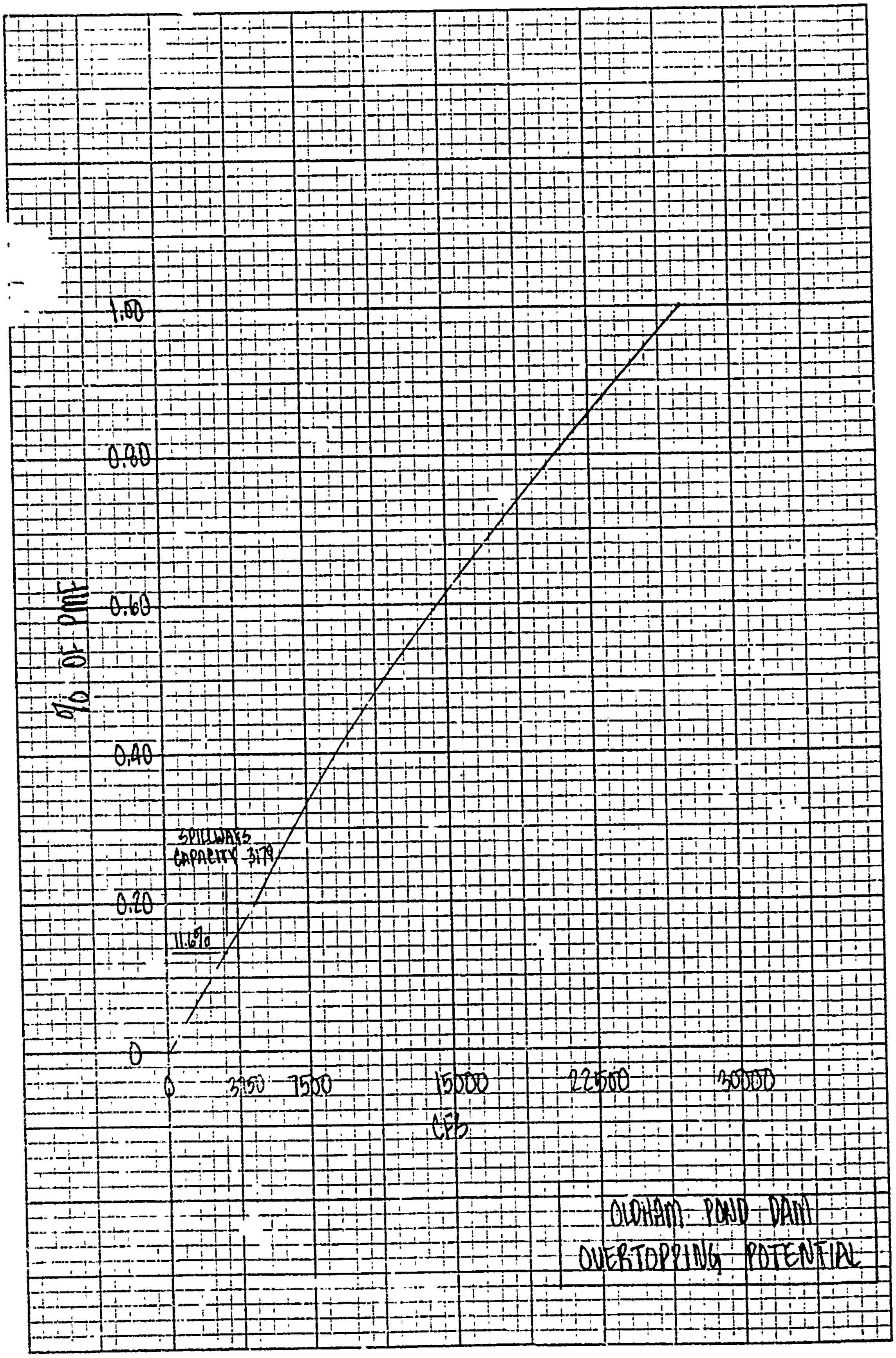
CHKD: FDD



SQUARES 1/4 SCALE

DRAWDOWN CALCULATIONS

CALCULATIONS ASSUME ① NO SIGNIFICANT INFLOW ② BOX CULVERT 2.5' X 3.0' LOW LEVEL OUTLET TO BE FULLY OPERABLE ③$^{\Delta}$ $Q_p = C_p(H)^{1/2}$ ④ ACRE-FT./DAY = 1.9835 (AVG. Q) ⑤ DAYS = Δ STOR / ACRE-FT./DAY

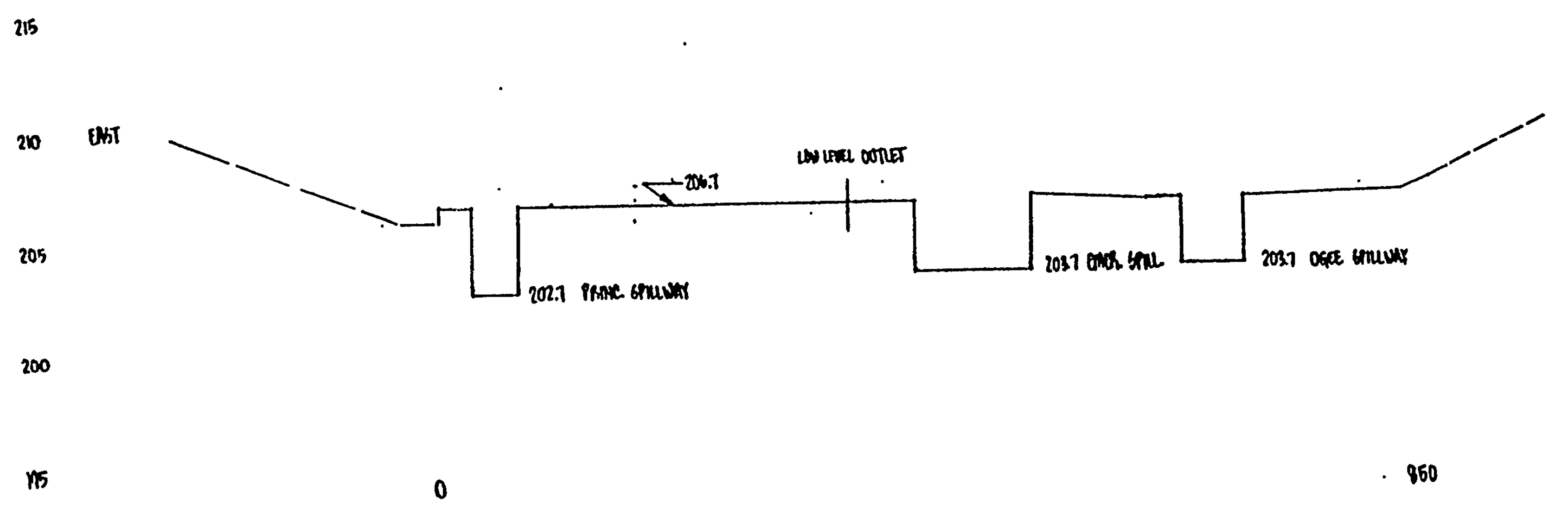
ELEVATION	STORAGE ACRE-FT.	Δ STOR. ACRE-FT.	H FT.	Q CFS	AVG. Q	ACRE-FT./DAY	DAYS
202	77		9.8	124			
		22			118	234	.09
200	55		7.8	111			
		14			103	204	.07
198	41		5.8	95			
		13			86	171	.08
196	28		3.8	77			
		13			65	129	.10
194	15		1.8	53			
		12			31	62	.20
ΔΔ 192	3		1.3	9			
		3			5	10	.30
190.7	0		0	0			

TOTAL = 0.84 DAY

$^{\Delta}$ $Q_p = C_p(H)^{1/2}$, $C_p = A_p\sqrt{\dfrac{2g}{1+K_L+K_F L_p}}$ $\quad C_p = 39.6$

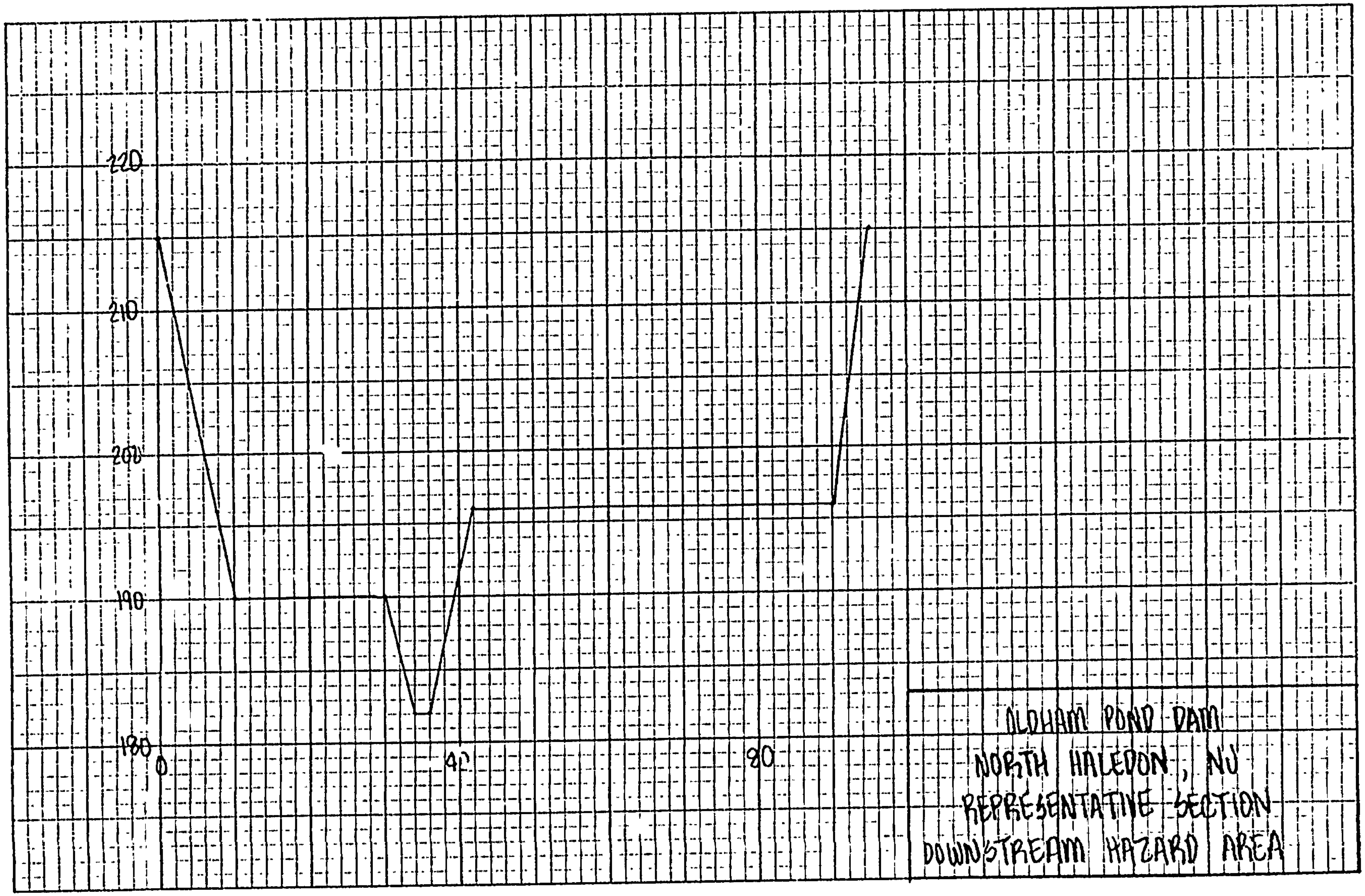
$^{\Delta\Delta}$ USE MANNING EQUATION : $Q = \dfrac{1.49}{n}(A)(R)^{2/3}(S)^{1/2}$

WHERE $n = .038$, $A = 3.25$, $R = .64$, $S = .01$



WEIR SECTION LOOKING D/S

ANDERSON-NICHOLS			
VERNON	BOSTON		CONCORD
OLDHAM POND DAM NORTH HALEDON, NJ			
DATE	SCALE:	JOB NO.	SHEET NO.


220
210
200
190
180
0
40
80
OLDHAM POND DAM
NORTH HALEDON, NJ
REPRESENTATIVE SECTION
DOWNSTREAM HAZARD AREA

HEC-1 OUTPUT

OVERTOPPING AND BREACH ANALYSIS

OLDHAM POND DAM

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*********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
  LAST MODIFICATION  26 FEB 79
*********************************
A1 OLDHAM POND DAM OVERTOPPING AND BREACH ANALYSIS *K.STUART**ANDERSON-NICHOLS*
A2 NEW JERSEY DAM NUMBER A30A
A3 0.2, 0.5, AND 1.0 MULTIPLES OF PMF FROM 6-HOUR 24.0 INCH PMP
B     120        0        5        0        0        0        0        0        0        0
B1      5
J       2        3        1
J1     .2       .5      1.0
K       0       A1                                            1
K1 HALEDON RESERVOIR INFLOW HYDROGRAPH BY ECI
M       0        2      1.6                         .8                          1
O      72
O1   .207     .207     .207     .207     .207     .207     .207     .207     .207     .207
O1   .207     .207     .248     .248     .248     .248     .248     .248     .248     .248
O1   .248     .248     .248     .248     .310     .310     .310     .310     .310     .310
O1   .310     .310     .310     .310     .310     .310     .188     .377     .377     .565
O1   .659    1.601    2.638    1.036     .659     .565     .377     .377     .289     .289
O1   .289     .289     .289     .289     .289     .289     .289     .289     .289     .289
O1   .227     .227     .227     .227     .227     .227     .227     .227     .227     .227
C1   .227     .227
T                                                             1       .1
W2                 .3
X      -3
K       1       A2                                            1
K1 ROUTE INFLOW THROUGH HALEDON RESERVOIR    ECI STORAGE-ELEVATION DISCHARGE
Y                                    1        1
Y1      1                                                   657       -1
Y4  412.0    414.0    415.0    415.5    415.9   416.06    416.1    416.5    417.0    419.0
Y5     0.     550.     725.     738.     744.     750.     950.    1800.    3000.   10260.
$S   657.     794.     881.     929.     967.     978.     987.    1028.    1083.    1325.
$E  412.0    414.0    415.0    415.5    415.9   416.06    416.1    416.5    417.0    419.0
$$  412.0
$D416.06
K       1       A3                                            1
K1 ROUTE HALEDON RESERVOIR OUTFLOW TO STREAM CONFLUENCE
Y                                    1        1
Y1      1                                                    -1
Y6   .070     .055     .070     320.     340.    8000.   .02025
Y7     0.     340.      14.     330.      46.     322.      50.     320.      58.     320.
Y7    62.     372.     135.     330.     154.     340.
K       0       A4                                            1
K1 DEVELOP INFLOW HYDROGRAPH FOR SUB-BASIN ONE
M       0        2      2.3                         .8                          1
O      72
O1   .207     .207     .207     .207     .207     .207     .207     .207     .207     .207
O1   .207     .207     .248     .248     .248     .248     .248     .240     .248     .248
O1   .248     .248     .248     .248     .310     .310     .310     .310     .310     .310
O1   .310     .310     .310     .310     .310     .310     .188     .377     .377     .565
O1   .659    1.601    2.638    1.036     .659     .565     .377     .377     .289     .289
O1   .289     .289     .289     .289     .289     .289     .289     .289     .289     .289
C1   .227     .227     .227     .227     .227     .227     .227     .227     .227     .227
```

72

```
C1   .227    .227
T                                                              1       .1
W2           .4
X     -3
K      2      A5                                               1
K1 COMBINE ROUTED HALEDON RESERVOIR AND SUB-BASIN ONE
K      1      A6                                               1
K1 ROUTE HALEDON RES/SUB 1 TO INLET OF OLDHAM POND
Y                                    1       1
Y1     1                                                      -1
Y6   .070    .055    .070    217.    246.   4000.   .0120
Y7     0.    246.     16.    230.     73.    219.     74.    217.     79.    217.
Y7    80.    219.     87.    220.    160.    246.
K      0      A7                                               1
K1 DEVELOP INFLOW HYDROGRAPH FOR SUB-BASIN TWO
M      0       2     1.4                      .8                                1
O     72
O1   .207    .207    .207    .207    .207    .207    .207    .207    .207    .207
O1   .207    .207    .248    .248    .248    .248    .248    .248    .248    .248
O1   .248    .248    .248    .248    .310    .310    .310    .310    .310    .310
O1   .310    .310    .310    .310    .310    .310    .188    .377    .377    .565
O1   .659   1.601   2.638   1.036    .659    .565    .377    .377    .289    .289
O1   .289    .289    .289    .289    .289    .289    .289    .289    .289    .289
O1   .227    .227    .227    .227    .227    .227    .227    .227    .227    .227
O1   .227    .227
T                                                              1       .1
W2           .4
X     -3
K      2      A8                                               1
K1 COMBINE ROUTED HALEDON RES/SUB 1 AND SUB 2
K      1      A9                                               1
K1 ROUTE COMBINED HYDROGRAPH THROUGH OLDHAM POND
Y                                    1       1
Y1     1                                                      77      -1
Y4  202.7   203.7   204.7   205.7   206.7   207.7   208.7   209.7
Y5     0.    103.    745.   1818.   3179.   7026.  13297.  21037.
$S     0.     77.     95.    114.    133.    153.    174.    196.    218.
$E  190.7   202.7   203.7   204.7   205.7   206.7   207.7   208.7   209.7
$$  202.7
$D  206.7
$B     30       1   190.7       1    202.   206.7
$B     50      .5   190.7       1    202.    230.
K      1     A10                                               1
K1 ROUTE OUTFLOW FROM OLDHAM POND DOWNSTREAM
Y                                    1       1
Y1     1                                                      -1
Y6   .070    .055    .070    182.    215.    600.   .0333
Y7     0.    215.     10.    190.     30.    190.     34.    182.     36.    182.
Y7    42.    196.     90.    196.     95.    215.
K     99
```

√3

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PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

     RUNOFF HYDROGRAPH AT              A1
     ROUTE HYDROGRAPH TO               A2
     ROUTE HYDROGRAPH TO               A3
     RUNOFF HYDROGRAPH AT              A4
     COMBINE   2 HYDROGRAPHS AT        A5
     ROUTE HYDROGRAPH TO               A6
     RUNOFF HYDROGRAPH AT              A7
     COMBINE   2 HYDROGRAPHS AT        A8
     ROUTE HYDROGRAPH TO               A9
     ROUTE HYDROGRAPH TO               A10
     END OF NETWORK
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**********************************
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
LAST MODIFICATION  26 FEB 79
**********************************

RUN  DATE* 80/01/24.
     TIME* 04.50.39.

OLDHAM POND DAM OVERTOPPING AND BREACH ANALYSIS *K.STUART**ANDERSON-NICHOLS*
NEW JERSEY DAM NUMBER 400A
0.2, 0.5, AND 1.0 MULTIPLES OF PMF FROM 6-HOUR 24.8 INCH PMP

                              JOB SPECIFICATION
  NO     NHR    NMIN    IDAY    IHR    IMIN   METRC    IPLT    IPRT   NSTAN
 120       0       5       0      0      0       0       0       0       0
                        JOPER   NWT   LROPT   TRACE
                            5     0       0       0

                     MULTI-PLAN ANALYSES TO BE PERFORMED
                        NPLAN= 2 NRTIO= 3 LRTIO= 1
  RTIOS=    .20     .50    1.00

**********          **********          **********          **********          **********

                          SUB-AREA RUNOFF COMPUTATION

HALEDON RESERVOIR INFLOW HYDROGRAPH BY ECI

            ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
               A1       0       0       0       0       0       1       0       0

                               HYDROGRAPH DATA
   IHYDG    IUHG   TAREA    SNAP   TRSDA   TRSPC   RATIO   ISNOW   ISAME   LOCAL
       0       2    1.60    0.00    1.60     .80   0.000       0       1       0

                                 PRECIP DATA
                          NP   STORM     DAJ     DAK
                          72    0.00    0.00    0.00
                                PRECIP PATTERN
   .21     .21     .21     .21     .21     .21     .21     .21     .21     .21
   .21     .21     .25     .25     .25     .25     .25     .25     .25     .25
   .25     .25     .25     .25     .31     .31     .31     .31     .31     .31
   .31     .31     .31     .31     .31     .31     .19     .38     .38     .57
   .66    1.60    2.64    1.04     .66     .57     .38     .38     .29     .29
   .29     .29     .29     .29     .29     .29     .29     .29     .29     .29
   .23     .23     .23     .23     .23     .23     .23     .23     .23     .23
   .23     .23

                                  LOSS DATA
  LROPT   STRKR   DLTKR   RTIOL   ERAIN   STRKS   RTIOK   STRTL   CNSTL   ALSMX   RTIMP
      0    0.00    0.00    1.00    0.00    0.00    1.00    1.00     .10    0.00    0.00

                             UNIT HYDROGRAPH DATA
                         TC=  0.00     LAG=   .30
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RECESSION DATA

STRTQ= -3.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 20 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .30 VOL= 1.00

316.	1021.	1938.	2261.	2077.	1624.	1031.	690.	473.	316.
214.	143.	96.	64.	44.	29.	21.	14.	8.	3.

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.17	0.00	.17	5.	1.01	5.05	61	.18	.17	.01	2796.
1.01	.10	2	.17	0.00	.17	5.	1.01	5.10	62	.18	.17	.01	2723.
1.01	.15	3	.17	0.00	.17	5.	1.01	5.15	63	.18	.17	.01	2613.
1.01	.20	4	.17	0.00	.17	5.	1.01	5.20	64	.18	.17	.01	2495.
1.01	.25	5	.17	0.00	.17	5.	1.01	5.25	65	.18	.17	.01	2389.
1.01	.30	6	.17	0.00	.17	5.	1.01	5.30	66	.18	.17	.01	2307.
1.01	.35	7	.17	.15	.01	53.	1.01	5.35	67	.18	.17	.01	2256.
1.01	.40	8	.17	.16	.01	209.	1.01	5.40	68	.18	.17	.01	2221.
1.01	.45	9	.17	.16	.01	508.	1.01	5.45	69	.18	.17	.01	2198.
1.01	.50	10	.17	.16	.01	862.	1.01	5.50	70	.18	.17	.01	2182.
1.01	.55	11	.17	.16	.01	1189.	1.01	5.55	71	.18	.17	.01	2171.
1.01	1.00	12	.17	.16	.01	1448.	1.01	6.00	72	.18	.17	.01	2164.
1.01	1.05	13	.20	.19	.01	1624.	1.01	6.05	73	0.00	0.00	0.00	2105.
1.01	1.10	14	.20	.19	.01	1768.	1.01	6.10	74	0.00	0.00	0.00	1925.
1.01	1.15	15	.20	.19	.01	1907.	1.01	6.15	75	0.00	0.00	0.00	1587.
1.01	1.20	16	.20	.19	.01	2032.	1.01	6.20	76	0.00	0.00	0.00	1194.
1.01	1.25	17	.20	.19	.01	2134.	1.01	6.25	77	0.00	0.00	0.00	833.
1.01	1.30	18	.20	.19	.01	2211.	1.01	6.30	78	0.00	0.00	0.00	551.
1.01	1.35	19	.20	.19	.01	2260.	1.01	6.35	79	0.00	0.00	0.00	371.
1.01	1.40	20	.20	.19	.01	2293.	1.01	6.40	80	0.00	0.00	0.00	252.
1.01	1.45	21	.20	.19	.01	2315.	1.01	6.45	81	0.00	0.00	0.00	170.
1.01	1.50	22	.20	.19	.01	2330.	1.01	6.50	82	0.00	0.00	0.00	115.
1.01	1.55	23	.20	.19	.01	2341.	1.01	6.55	83	0.00	0.00	0.00	78.
1.01	2.00	24	.20	.19	.01	2348.	1.01	7.00	84	0.00	0.00	0.00	53.
1.01	2.05	25	.25	.24	.01	2368.	1.01	7.05	85	0.00	0.00	0.00	37.
1.01	2.10	26	.25	.24	.01	2421.	1.01	7.10	86	0.00	0.00	0.00	25.
1.01	2.15	27	.25	.24	.01	2519.	1.01	7.15	87	0.00	0.00	0.00	18.
1.01	2.20	28	.25	.24	.01	2632.	1.01	7.20	88	0.00	0.00	0.00	13.
1.01	2.25	29	.25	.24	.01	2735.	1.01	7.25	89	0.00	0.00	0.00	9.
1.01	2.30	30	.25	.24	.01	2816.	1.01	7.30	90	0.00	0.00	0.00	7.
1.01	2.35	31	.25	.24	.01	2868.	1.01	7.35	91	0.00	0.00	0.00	5.
1.01	2.40	32	.25	.24	.01	2902.	1.01	7.40	92	0.00	0.00	0.00	5.
1.01	2.45	33	.25	.24	.01	2926.	1.01	7.45	93	0.00	0.00	0.00	5.
1.01	2.50	34	.25	.24	.01	2941.	1.01	7.50	94	0.00	0.00	0.00	5.
1.01	2.55	35	.25	.24	.01	2952.	1.01	7.55	95	0.00	0.00	0.00	5.
1.01	3.00	36	.25	.24	.01	2959.	1.01	8.00	96	0.00	0.00	0.00	5.
1.01	3.05	37	.15	.14	.01	2933.	1.01	8.05	97	0.00	0.00	0.00	5.
1.01	3.10	38	.30	.29	.01	2884.	1.01	8.10	98	0.00	0.00	0.00	5.
1.01	3.15	39	.30	.29	.01	2852.	1.01	8.15	99	0.00	0.00	0.00	5.
1.01	3.20	40	.45	.44	.01	2973.	1.01	8.20	100	0.00	0.00	0.00	5.
1.01	3.25	41	.53	.52	.01	3291.	1.01	8.25	101	0.00	0.00	0.00	5.
1.01	3.30	42	1.28	1.27	.01	4053.	1.01	8.30	102	0.00	0.00	0.00	5.
1.01	3.35	43	2.11	2.10	.01	5716.	1.01	8.35	103	0.00	0.00	0.00	5.
1.01	3.40	44	.83	.82	.01	8190.	1.01	8.40	104	0.00	0.00	0.00	5.
1.01	3.45	45	.53	.52	.01	10556.	1.01	8.45	105	0.00	0.00	0.00	5.
1.01	3.50	46	.45	.44	.01	11500.	1.01	8.50	106	0.00	0.00	0.00	5.
1.01	3.55	47	.30	.29	.01	11048.	1.01	8.55	107	0.00	0.00	0.00	5.
1.01	4.00	48	.30	.29	.01	9671.	1.01	9.00	108	0.00	0.00	0.00	5.
1.01	4.05	49	.27	.22	.01	7950.	1.01	9.05	109	0.00	0.00	0.00	5.

1.01	4.10	50	.23	.22	.01	6564.	1.01	9.10	110	0.00	0.00	0.00	5.
1.01	4.15	51	.23	.22	.01	5471.	1.01	9.15	111	0.00	0.00	0.00	5.
1.01	4.20	52	.23	.22	.01	4627.	1.01	9.20	112	0.00	0.00	0.00	5.
1.01	4.25	53	.23	.22	.01	4032.	1.01	9.25	113	0.00	0.00	0.00	5.
1.01	4.30	54	.23	.22	.01	3612.	1.01	9.30	114	0.00	0.00	0.00	5.
1.01	4.35	55	.23	.22	.01	3334.	1.01	9.35	115	0.00	0.00	0.00	5.
1.01	4.40	56	.23	.22	.01	3149.	1.01	9.40	116	0.00	0.00	0.00	5.
1.01	4.45	57	.23	.22	.01	3023.	1.01	9.45	117	0.00	0.00	0.00	5.
1.01	4.50	58	.23	.22	.01	2940.	1.01	9.50	118	0.00	0.00	0.00	5.
1.01	4.55	59	.23	.22	.01	2884.	1.01	9.55	119	0.00	0.00	0.00	5.
1.01	5.00	60	.23	.22	.01	2843.	1.01	10.00	120	0.00	0.00	0.00	5.
									SUM	19.83	18.28	1.55	227005.
										(504.)	(464.)	(39.)	(6428.07)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11500.	3139.	1892.	1892.	226989.
CMS	326.	89.	54.	54.	6428.
INCHES		18.25	18.33	18.33	18.33
MM		463.56	465.56	465.56	465.56
AC-FT		1557.	1563.	1563.	1563.
THOUS CU M		1920.	1928.	1928.	1928.

HYDROGRAPH AT STA A1 FOR PLAN 1, RTIO 3

5.	5.	5.	5.	5.	5.	53.	209.	508.	862.
1189.	1448.	1624.	1768.	1907.	2032.	2134.	2211.	2260.	2293.
2315.	2330.	2341.	2348.	2368.	2421.	2519.	2632.	2735.	2816.
2868.	2902.	2926.	2941.	2952.	2959.	2933.	2884.	2852.	2973.
3291.	4053.	5716.	8190.	10556.	11500.	11048.	9671.	7950.	6564.
5471.	4627.	4032.	3612.	3334.	3149.	3023.	2940.	2884.	2843.
2796.	2723.	2613.	2495.	2389.	2307.	2256.	2221.	2198.	2182.
2171.	2164.	2105.	1925.	1587.	1194.	833.	551.	371.	252.
170.	115.	78.	53.	37.	25.	18.	13.	9.	7.
5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	5.	5.	5.
5.	5.	5.	5.	5.	5.	5.	5.	5.	5.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	11500.	3139.	1892.	1892.	226989.
CMS	326.	89.	54.	54.	6428.
INCHES		18.25	18.33	18.33	18.33
MM		463.56	465.56	465.56	465.56
AC-FT		1557.	1563.	1563.	1563.
THOUS CU M		1920.	1928.	1928.	1928.

PLAN 2 SAME AS PLAN 1

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     **********          **********          **********          **********          **********

                                      HYDROGRAPH ROUTING

               ROUTE INFLOW THROUGH HALEDON RESERVOIR     ECI STORAGE-ELEVATION DISCHARGE

                          ISTAQ    ICOMP    IECON    ITAPE     JPLT     JPRT    INAME   ISTAGE    IAUTO
                             A2        1        0        0        0        0        1        0        0

                                            ALL PLANS HAVE SAME
                                               ROUTING DATA
                       QLOSS    CLOSS      AVG     IRES    ISAME     IOPT     IPMP             LSTR
                         0.0    0.000     0.00        1        1        0        0                0

                          NSTPS    NSTDL      LAG    AMSKK        X      TSK    STORA   ISPRAT
                              1        0        0    0.000    0.000    0.000     657.       -1

STAGE      412.00    414.00    415.00    415.50    415.90    416.06    416.10    416.50    417.00    419.00

FLOW         0.00    550.00    725.00    730.00    744.00    750.00    550.00   1800.00   3000.00  10268.00

CAPACITY=     657.      799.      881.      929.      967.      978.      987.     1028.     1113.     1325.

ELEVATION=    412.      414.      415.      416.      416.      416.      416.      417.      417.      419.

                         CREL    SPWID     COQW     EXPW    ELEVL     COOL    CAREA     EXPL
                        412.0      0.0      0.0      0.0      0.0      0.0      0.0      0.0

                                                DAM DATA
                                     TOPEL     COQD     EXPD    DAMWID
                                     416.1      0.0      0.0        0.

                              STATION     A2, PLAN 1, RATIO 2

                                END-OF-PERIOD HYDROGRAPH ORDINATES

                                              OUTFLOW
         0.        0.        0.        1.        1.        1.        1.        5.       15.       33.
        60.       94.      134.      176.      222.      269.      319.      369.      420.      471.
       521.      560.      588.      609.      633.      657.      682.      708.      720.      730.
       734.      738.      740.      743.      748.      993.     1253.     1474.     1659.     1028.
      2009.     2242.     2611.     3292.     4432.     5668.     6719.     7402.     7666.     7589.
      7294.     6073.     6397.     5914.     5456.     5041.     4675.     4357.     4086.     3857.
      3663.     3493.     3339.     3192.     3051.     2941.     2850.     2765.     2688.     2619.
      2556.     2504.     2453.     2392.     2304.     2177.     2015.     1830.     1646.     1469.
      1301.     1147.     1007.      877.      757.      747.      745.      743.      743.      742.
       741.      740.      739.      739.      738.      736.      735.      734.      732.      731.
       730.      728.      727.      726.      719.      709.      700.      690.      681.      672.
       663.      654.      645.      636.      627.      619.      610.      602.      594.      586.
```

STORAGE

657.	657.	657.	657.	657.	657.	657.	658.	661.	665.
672.	680.	690.	701.	712.	724.	736.	749.	762.	774.
787.	799.	811.	823.	835.	847.	860.	873.	886.	900.
915.	929.	944.	960.	975.	989.	1002.	1012.	1021.	1029.
1038.	1048.	1065.	1093.	1131.	1172.	1207.	1230.	1238.	1236.
1226.	1212.	1196.	1180.	1165.	1151.	1139.	1128.	1119.	1112.
1105.	1099.	1094.	1089.	1085.	1080.	1076.	1072.	1069.	1066.
1063.	1060.	1058.	1055.	1051.	1045.	1038.	1029.	1021.	1012.
1004.	996.	990.	984.	978.	973.	968.	963.	958.	953.
948.	943.	938.	933.	928.	923.	918.	913.	908.	903.
898.	893.	888.	883.	878.	873.	868.	864.	859.	854.
850.	845.	841.	837.	832.	828.	824.	820.	816.	812.

STAGE

412.0	412.0	412.0	412.0	412.0	412.0	412.0	412.0	412.1	412.1
412.2	412.3	412.5	412.6	412.8	413.0	413.2	413.3	413.5	413.7
413.9	414.1	414.2	414.3	414.5	414.6	414.8	414.9	415.1	415.2
415.4	415.5	415.7	415.8	416.0	416.1	416.2	416.3	416.4	416.5
416.6	416.7	416.8	417.1	417.4	417.7	418.0	418.2	418.3	418.3
418.2	418.1	417.9	417.8	417.7	417.6	417.5	417.4	417.3	417.2
417.2	417.1	417.1	417.1	417.0	417.0	416.9	416.9	416.9	416.8
416.8	416.8	416.8	416.7	416.7	416.7	416.6	416.5	416.4	416.3
416.3	416.2	416.1	416.1	416.1	416.0	415.9	415.9	415.8	415.8
415.7	415.6	415.6	415.5	415.5	415.4	415.4	415.3	415.3	415.2
415.2	415.1	415.1	415.0	415.0	414.9	414.9	414.8	414.7	414.7
414.6	414.6	414.5	414.5	414.4	414.4	414.3	414.3	414.2	414.2

PEAK OUTFLOW IS 7666. AT TIME 4.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7666.	2557.	1705.	1705.	204639.
CMS	217.	72.	48.	48.	5795.
INCHES		14.86	16.52	16.52	16.52
MM		377.54	419.72	419.72	419.72
AC-FT		1268.	1409.	1409.	1409.
THOUS CU M		1564.	1738.	1738.	1738.

STATION A2, PLAN 2, RATIO 3

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	1.	1.	1.	1.	5.	15.	33.
60.	94.	130.	176.	222.	269.	319.	369.	420.	471.
521.	560.	584.	609.	633.	657.	682.	708.	726.	730.
734.	738.	740.	743.	748.	993.	1253.	1474.	1659.	1828.
2009.	2242.	2611.	3292.	4432.	5668.	6719.	7402.	7666.	7589.
7290.	6873.	6397.	5914.	5456.	5041.	4675.	4357.	4086.	3857.
3663.	3493.	3339.	3192.	3051.	2941.	2850.	2765.	2680.	2612.
2558.	2504.	2453.	2392.	2304.	2177.	2015.	1830.	1646.	1469.
1301.	1147.	1007.	877.	757.	747.	745.	743.	743.	742.
741.	740.	739.	739.	738.	736.	735.	734.	732.	731.
730.	728.	727.	726.	719.	709.	700.	690.	681.	672.
663.	654.	645.	636.	627.	619.	610.	602.	594.	586.

STORAGE

657.	657.	657.	657.	657.	657.	657.	658.	661.	665.
672.	680.	690.	701.	712.	724.	736.	749.	762.	774.
707.	799.	811.	823.	835.	847.	860.	873.	886.	900.
915.	929.	944.	960.	975.	989.	1002.	1012.	1021.	1029.
1038.	1048.	1065.	1093.	113[illegible]	1172.	1207.	1230.	1238.	1236.
1226.	1212.	1196.	1180.	1165.	1151.	1139.	1128.	1119.	1112.
1105.	1099.	1094.	1089.	1085.	1080.	1076.	1072.	1069.	1066.
1063.	1060.	1058.	1055.	1051.	1045.	1038.	1029.	1021.	1012.
1004.	996.	990.	984.	978.	973.	968.	963.	958.	953.
948.	943.	938.	933.	928.	923.	918.	913.	908.	903.
898.	893.	888.	883.	878.	873.	868.	864.	859.	854.
850.	845.	841.	837.	832.	828.	824.	820.	816.	812.

STAGE

412.0	412.0	412.0	412.0	412.0	412.0	412.0	412.0	412.1	412.1
412.2	412.3	412.5	412.6	412.8	413.0	413.2	413.3	413.5	413.7
413.9	414.1	414.2	414.3	414.5	414.6	414.8	414.9	415.1	415.2
415.4	415.5	415.7	415.8	416.0	416.1	416.2	416.3	416.4	416.5
416.6	416.7	416.8	417.1	417.4	417.7	418.0	418.2	418.3	418.3
418.2	418.1	417.9	417.8	417.7	417.6	417.5	417.4	417.3	417.2
417.2	417.1	417.1	417.1	417.0	417.0	416.9	416.9	416.9	416.8
416.8	416.8	416.8	416.7	416.7	416.7	416.6	416.5	416.4	416.3
416.3	416.2	416.1	416.1	416.1	416.0	415.9	415.9	415.8	415.8
415.7	415.6	415.6	415.5	415.5	415.4	415.4	415.3	415.3	415.2
415.2	415.1	415.1	415.0	415.0	414.9	414.9	414.8	414.7	414.7
414.6	414.6	414.5	414.5	414.4	414.4	414.3	414.3	414.2	414.2

PEAK OUTFLOW IS 7666. AT TIME 4.00 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7666.	2557.	1705.	1705.	204630.
CMS	217.	72.	48.	48.	5795.
INCHES		14.86	16.52	16.52	16.52
MM		377.54	419.72	419.72	419.72
AC-FT		1268.	1409.	1409.	1409.
THOUS CU M		1564.	1738.	1738.	1738.

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HYDROGRAPH ROUTING

ROUTE HALFOON RESERVOIR OUTFLOW TO STREAM CONFLUENCE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A3	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0700	.0550	.0700	320.0	340.0	8000.	.02025

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

```
  0.00  340.00   14.00  330.00   46.00  322.00   50.00  320.00   58.00  320.00
 62.00  322.00  135.00  330.00  154.00  340.00
```

STORAGE	0.00	1.95	4.73	9.43	16.79	26.83	39.54	54.92	72.97	93.69
	116.83	140.89	165.63	191.04	217.11	243.86	271.28	299.38	328.14	357.58
OUTFLOW	0.00	36.42	130.69	321.12	630.89	1091.28	1729.40	2570.06	3636.45	4950.58
	6629.43	8662.79	10940.10	13454.52	16201.20	19176.72	22378.73	25805.64	29456.51	33330.88
STAGE	320.00	321.05	322.11	323.16	324.21	325.26	326.32	327.37	328.42	329.47
	330.53	331.58	332.63	333.68	334.74	335.79	336.84	337.89	338.95	340.00
FLOW	0.00	36.42	130.69	321.12	630.89	1091.28	1729.40	2570.06	3636.45	4950.58
	6629.43	8662.79	10940.10	13454.52	16201.20	19176.72	22378.73	25805.64	29456.51	33330.88

STATION A3, PLAN 1, RTIO 3

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	1.	2.	4.
10.	18.	29.	50.	81.	116.	157.	203.	250.	298.
347.	396.	441.	480.	516.	548.	579.	608.	636.	661.
681.	696.	708.	717.	725.	764.	862.	999.	1159.	1331.
1504.	1688.	1918.	2246.	2770.	3541.	4486.	5462.	6250.	6850.
7117.	7102.	6891.	6568.	6215.	5829.	5441.	5071.	4754.	4474.
4218.	3988.	3783.	3600.	3438.	3289.	3156.	3038.	2933.	2838.
2754.	2679.	2611.	2549.	2485.	2408.	2309.	2187.	2045.	1890.
1730.	1581.	1432.	1288.	1149.	1036.	957.	899.	857.	825.
802.	786.	773.	764.	757.	751.	747.	744.	741.	738.
736.	734.	732.	731.	728.	725.	719.	713.	705.	697.
689.	681.	672.	663.	655.	646.	637.	629.	621.	613.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	2.	2.	3.	4.	5.	7.	8.	9.
10.	11.	12.	13.	14.	15.	16.	16.	17.	17.
18.	18.	18.	19.	19.	20.	22.	25.	28.	32.
35.	39.	43.	49.	58.	71.	86.	101.	112.	119.
123.	122.	120.	116.	111.	106.	100.	95.	91.	86.
82.	79.	75.	72.	70.	67.	65.	63.	61.	59.
58.	57.	56.	55.	53.	52.	50.	48.	45.	42.
40.	37.	34.	31.	28.	26.	24.	23.	22.	21.
21.	20.	20.	20.	20.	19.	19.	19.	19.	19.
19.	19.	19.	19.	19.	19.	19.	19.	18.	18.
18.	18.	18.	17.	17.	17.	17.	17.	17.	16.

STAGE

320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.1	320.1
320.3	320.5	320.8	321.2	321.6	321.9	322.3	322.5	322.8	323.0
323.2	323.4	323.6	323.7	323.8	323.9	324.0	324.1	324.2	324.3
324.3	324.4	324.4	324.4	324.4	324.5	324.7	325.1	325.4	325.7
325.9	326.2	326.6	327.0	327.6	328.3	329.1	329.8	330.3	330.6
330.8	330.8	330.7	330.5	330.3	330.0	329.8	329.5	329.3	329.1
328.9	328.7	328.5	328.4	328.2	328.1	327.9	327.8	327.7	327.6
327.5	327.5	327.4	327.3	327.3	327.2	327.0	326.9	326.7	326.5
326.3	326.1	325.8	325.6	325.4	325.1	325.0	324.8	324.7	324.7
324.6	324.6	324.5	324.5	324.5	324.5	324.5	324.5	324.5	324.5
324.5	324.4	324.4	324.4	324.4	324.4	324.4	324.4	324.4	324.4
324.3	324.3	324.3	324.3	324.3	324.2	324.2	324.2	324.2	324.2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7117.	2555.	1686.	1686.	202263.
CMS	202.	72.	48.	48.	5727.
INCHES		14.86	16.33	16.33	16.33
MM		377.38	414.85	414.85	414.85
AC-FT		1267.	1393.	1393.	1393.
THOUS CU M		1563.	1718.	1718.	1718.

MAXIMUM STORAGE = 123.

MAXIMUM STAGE IS 330.8

STATION A3, PLAN 2, RTIO 3

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	1.	2.	4.
10.	18.	29.	50.	81.	116.	157.	203.	250.	298.
347.	396.	441.	480.	517.	548.	579.	608.	636.	661.
681.	696.	706.	717.	725.	764.	812.	999.	1159.	1331.
1504.	1688.	1918.	2246.	2770.	3541.	4486.	5462.	6290.	6850.
7117.	7102.	6891.	6568.	6215.	5829.	5441.	5071.	4754.	4474.
4218.	3988.	3783.	3600.	3478.	3289.	3156.	3038.	2933.	2838.
2754.	2679.	2611.	2547.	2485.	2408.	2329.	2187.	2045.	1890.
1730.	1581.	1432.	1288.	1149.	1036.	917.	899.	857.	825.
802.	786.	773.	764.	757.	751.	747.	744.	741.	738.
736.	734.	732.	731.	728.	725.	719.	713.	705.	697.
689.	681.	672.	663.	655.	646.	637.	629.	621.	613.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	2.	2.	3.	4.	5.	7.	8.	9.
10.	11.	12.	13.	14.	15.	16.	16.	17.	17.
18.	18.	18.	19.	19.	20.	22.	25.	28.	32.
35.	39.	43.	49.	58.	71.	86.	101.	112.	119.
123.	122.	120.	116.	111.	106.	100.	95.	91.	86.
82.	79.	75.	72.	70.	67.	65.	63.	61.	59.
58.	57.	56.	55.	53.	52.	50.	48.	45.	42.
40.	37.	34.	31.	28.	26.	24.	23.	22.	21.
21.	20.	20.	20.	20.	19.	19.	19.	19.	19.
19.	19.	19.	19.	19.	19.	19.	19.	18.	18.
18.	18.	18.	17.	17.	17.	17.	17.	17.	16.

STAGE

320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.0	320.1	320.1
320.3	320.5	320.8	321.2	321.6	321.9	322.3	322.5	322.8	323.0
323.2	323.4	323.6	323.7	323.8	323.9	324.0	324.1	324.2	324.3
324.3	324.4	324.4	324.4	324.4	324.5	324.7	325.1	325.4	325.7
325.9	326.2	326.6	327.0	327.6	328.3	329.1	329.8	330.3	330.6
330.8	330.8	330.7	330.5	330.3	330.0	329.8	329.5	329.3	329.1
328.9	328.7	328.5	328.4	328.2	328.1	327.9	327.8	327.7	327.6
327.5	327.5	327.4	327.3	327.3	327.2	327.0	326.9	326.7	326.5
326.3	326.1	325.8	325.6	325.4	325.1	325.0	324.8	324.7	324.7
324.6	324.6	324.5	324.5	324.5	324.5	324.5	324.5	324.5	324.5
324.5	324.4	324.4	324.4	324.4	324.4	324.4	324.4	324.4	324.4
324.3	324.3	324.3	324.3	324.3	324.2	324.2	324.2	324.2	324.2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	7117.	2555.	1686.	1686.	202263.
CMS	202.	72.	48.	48.	5727.
INCHES		14.86	16.33	16.33	16.33
MM		377.38	414.85	414.85	414.85
AC-FT		1267.	1393.	1393.	1393.
THOUS CU M		1563.	1718.	1718.	1718.

MAXIMUM STORAGE = 123.

MAXIMUM STAGE IS 330.8

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SUB-AREA RUNOFF COMPUTATION

DEVELOP INFLOW HYDROGRAPH FOR SUB-BASIN ONE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A4	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	2	2.30	0.00	2.30	.80	0.000	0	1	0

PRECIP DATA

NP	STORM	DAJ	DAK
72	0.00	0.00	0.00

PRECIP PATTERN

.21	.21	.21	.21	.21	.21	.21	.21	.21	.21
.21	.21	.25	.25	.25	.25	.25	.25	.25	.25
.25	.25	.25	.25	.31	.31	.31	.31	.31	.31
.31	.31	.31	.31	.31	.31	.19	.38	.38	.57
.66	1.60	2.64	1.04	.66	.57	.38	.38	.29	.29
.29	.29	.29	.29	.29	.29	.29	.29	.29	.29
.23	.23	.23	.23	.23	.23	.23	.23	.23	.23
.23	.23								

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .40

RECESSION DATA

STRTQ= -3.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 26 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .40 VOL= 1.00

232.	712.	1498.	2215.	2502.	2443.	2122.	1683.	1162.	850.
635.	472.	343.	254.	185.	135.	100.	73.	54.	40.
30.	23.	17.	12.	7.	2.				

0

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.17	0.00	.17	7.	1.01	5.05	61	.18	.17	.01	4256.
1.01	.10	2	.17	0.00	.17	7.	1.01	5.10	62	.18	.17	.01	4144.
1.01	.15	3	.17	0.00	.17	7.	1.01	5.15	63	.18	.17	.01	4014.
1.01	.20	4	.17	0.00	.17	7.	1.01	5.20	64	.18	.17	.01	3864.
1.01	.25	5	.17	0.00	.17	7.	1.01	5.25	65	.18	.17	.01	3707.
1.01	.30	6	.17	0.00	.17	7.	1.01	5.30	66	.18	.17	.01	3559.
1.01	.35	7	.17	.15	.01	42.	1.01	5.35	67	.18	.17	.01	3431.
1.01	.40	8	.17	.16	.01	151.	1.01	5.40	68	.18	.17	.01	3329.
1.01	.45	9	.17	.16	.01	382.	1.01	5.45	69	.18	.17	.01	3241.
1.01	.50	10	.17	.16	.01	726.	1.01	5.50	70	.18	.17	.01	3214.
1.01	.55	11	.17	.16	.01	1117.	1.01	5.55	71	.18	.17	.01	3180.
1.01	1.00	12	.17	.16	.01	1502.	1.01	6.00	72	.18	.17	.01	3155.
1.01	1.05	13	.20	.19	.01	1845.	1.01	6.05	73	0.00	0.00	0.00	3090.
1.01	1.10	14	.20	.19	.01	2136.	1.01	6.10	74	0.00	0.00	0.00	2962.
1.01	1.15	15	.20	.19	.01	2371.	1.01	6.15	75	0.00	0.00	0.00	2683.
1.01	1.20	16	.20	.19	.01	2579.	1.01	6.20	76	0.00	0.00	0.00	2302.
1.01	1.25	17	.20	.19	.01	2763.	1.01	6.25	77	0.00	0.00	0.00	1864.
1.01	1.30	18	.20	.19	.01	2918.	1.01	6.30	78	0.00	0.00	0.00	1437.
1.01	1.35	19	.20	.19	.01	3042.	1.01	6.35	79	0.00	0.00	0.00	1067.
1.01	1.40	20	.20	.19	.01	3138.	1.01	6.40	80	0.00	0.00	0.00	773.
1.01	1.45	21	.20	.19	.01	3206.	1.01	6.45	81	0.00	0.00	0.00	576.
1.01	1.50	22	.20	.19	.01	3255.	1.01	6.50	82	0.00	0.00	0.00	422.
1.01	1.55	23	.20	.19	.01	3292.	1.01	6.55	83	0.00	0.00	0.00	311.
1.01	2.00	24	.20	.19	.01	3319.	1.01	7.00	84	0.00	0.00	0.00	226.
1.01	2.05	25	.25	.24	.01	3350.	1.01	7.05	85	0.00	0.00	0.00	169.
1.01	2.10	26	.25	.24	.01	3400.	1.01	7.10	86	0.00	0.00	0.00	125.

1.01	2.15	27	.25	.24	.01	3485.	1.01	7.15	87	0.00	0.00	0.00	92.
1.01	2.20	28	.25	.24	.01	3603.	1.01	7.20	88	0.00	0.00	0.00	69.
1.01	2.25	29	.25	.24	.01	3734.	1.01	7.25	89	0.00	0.00	0.00	52.
1.01	2.30	30	.25	.24	.01	3859.	1.01	7.30	90	0.00	0.00	0.00	39.
1.01	2.35	31	.25	.24	.01	3967.	1.01	7.35	91	0.00	0.00	0.00	30.
1.01	2.40	32	.25	.24	.01	4052.	1.01	7.40	92	0.00	0.00	0.00	23.
1.01	2.45	33	.25	.24	.01	4111.	1.01	7.45	93	0.00	0.00	0.00	17.
1.01	2.50	34	.25	.24	.01	4154.	1.01	7.50	94	0.00	0.00	0.00	14.
1.01	2.55	35	.25	.24	.01	4186.	1.01	7.55	95	0.00	0.00	0.00	11.
1.01	3.00	36	.25	.24	.01	4210.	1.01	8.00	96	0.00	0.00	0.00	9.
1.01	3.05	37	.15	.14	.01	4205.	1.01	8.05	97	0.00	0.00	0.00	7.
1.01	3.10	38	.30	.29	.01	4183.	1.01	8.10	98	0.00	0.00	0.00	7.
1.01	3.15	39	.30	.29	.01	4153.	1.01	8.15	99	0.00	0.00	0.00	7.
1.01	3.20	40	.45	.44	.01	4205.	1.01	8.20	100	0.00	0.00	0.00	7.
1.01	3.25	41	.53	.52	.01	4425.	1.01	8.25	101	0.00	0.00	0.00	7.
1.01	3.30	42	1.28	1.27	.01	5022.	1.01	8.30	102	0.00	0.00	0.00	7.
1.01	3.35	43	2.11	2.10	.01	6362.	1.01	8.35	103	0.00	0.00	0.00	7.
1.01	3.40	44	.83	.82	.01	8486.	1.01	8.40	104	0.00	0.00	0.00	7.
1.01	3.45	45	.53	.52	.01	11114.	1.01	8.45	105	0.00	0.00	0.00	7.
1.01	3.50	46	.45	.44	.01	13281.	1.01	8.50	106	0.00	0.00	0.00	7.
1.01	3.55	47	.30	.29	.01	14299.	1.01	8.55	107	0.00	0.00	0.00	7.
1.01	4.00	48	.30	.29	.01	14182.	1.01	9.00	108	0.00	0.00	0.00	7.
1.01	4.05	49	.23	.22	.01	13171.	1.01	9.05	109	0.00	0.00	0.00	7.
1.01	4.10	50	.23	.22	.01	11602.	1.01	9.10	110	0.00	0.00	0.00	7.
1.01	4.15	51	.23	.22	.01	9884.	1.01	9.15	111	0.00	0.00	0.00	7.
1.01	4.20	52	.23	.22	.01	8490.	1.01	9.20	112	0.00	0.00	0.00	7.
1.01	4.25	53	.23	.22	.01	7385.	1.01	9.25	113	0.00	0.00	0.00	7.
1.01	4.30	54	.23	.22	.01	6568.	1.01	9.30	114	0.00	0.00	0.00	7.
1.01	4.35	55	.23	.22	.01	5839.	1.01	9.35	115	0.00	0.00	0.00	7.
1.01	4.40	56	.23	.22	.01	5342.	1.01	9.40	116	0.00	0.00	0.00	7.
1.01	4.45	57	.23	.22	.01	4977.	1.01	9.45	117	0.00	0.00	0.00	7.
1.01	4.50	58	.23	.22	.01	4709.	1.01	9.50	118	0.00	0.00	0.00	7.
1.01	4.55	59	.23	.22	.01	4515.	1.01	9.55	119	0.00	0.00	0.00	7.
1.01	5.00	60	.23	.22	.01	4372.	1.01	10.00	120	0.00	0.00	0.00	7.

SUM 19.83 18.28 1.55 326308.
(504.)(464.)(39.)(9240.01)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	14299.	4497.	2719.	2719.	326297.
CMS	405.	127.	77.	77.	9240.
INCHES		18.19	18.33	18.33	18.33
MM		462.03	465.56	465.56	465.56
AC-FT		2230.	2247.	2247.	2247.
THOUS CU M		2751.	2772.	2772.	2772.

HYDROGRAPH AT STA A4 FOR PLAN 1, RTIO 3

7.	7.	7.	7.	7.	7.	42.	151.	382.	726.
1117.	1502.	1845.	2136.	2371.	2579.	2763.	2916.	3042.	3138.
3206.	3255.	3292.	3319.	3350.	3400.	3485.	3603.	3734.	3859.
3967.	4052.	4111.	4154.	4186.	4210.	4205.	4183.	4153.	4205.
4425.	5022.	6362.	8486.	11114.	13281.	14299.	14182.	13171.	11602.
9884.	8490.	7305.	6508.	5839.	5342.	4977.	4709.	4515.	4372.
4256.	4144.	4014.	3864.	3707.	3559.	3431.	3329.	3261.	3214.
3180.	3155.	3098.	2962.	2693.	2302.	1864.	1437.	1067.	773.
570.	422.	311.	228.	169.	125.	92.	69.	52.	39.
30.	23.	18.	14.	11.	9.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	7.	7.	7.
7.	7.	7.	7.	7.	7.	7.	7.	7.	7.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	14299.	4497.	2719.	2719.	326297.
CMS	405.	127.	77.	77.	9240.
INCHES		18.19	18.33	18.33	18.33
MM		462.03	465.56	465.56	465.56
AC-FT		2230.	2247.	2247.	2247.
THOUS CU M		2751.	2772.	2772.	2772.

PLAN 2 SAME AS PLAN 1

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COMBINE HYDROGRAPHS

COMBINE ROUTED HALFDON RESERVOIR AND SUB-BASIN ONE

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A5	2	0	0	0	0	1	0	0

SUM OF 2 HYDROGRAPHS AT A5 PLAN 1 RTIO 3

7.	7.	7.	7.	7.	7.	42.	152.	384.	730.
1127.	1520.	1875.	2186.	2453.	2695.	2919.	3121.	3292.	3436.
3553.	3651.	3732.	3799.	3866.	3949.	4064.	4212.	4370.	4520.
4648.	4748.	4819.	4871.	4911.	4974.	5067.	5182.	5312.	5536.
5930.	6710.	8280.	10731.	13889.	16822.	18785.	19644.	19461.	18451.
17000.	15592.	14277.	13075.	12053.	11170.	10418.	9780.	9269.	8846.
8474.	8132.	7797.	7464.	7145.	6848.	6587.	6367.	6193.	6052.
5934.	5834.	5709.	5510.	5178.	4710.	4173.	3624.	3111.	2663.
2300.	2003.	1743.	1516.	1318.	1161.	1050.	968.	908.	864.
832.	808.	791.	777.	767.	760.	754.	751.	748.	745.
743.	741.	739.	738.	735.	731.	726.	719.	712.	704.
696.	688.	679.	670.	662.	653.	644.	636.	628.	620.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	19644.	6903.	4405.	4405.	528560.
CMS	556.	195.	125.	125.	14967.
INCHES		16.46	17.51	17.51	17.51
MM		418.21	444.76	444.76	444.76
AC-FT		3423.	3640.	3640.	3640.
THOUS CU M		4222.	4490.	4490.	4490.

SUM OF 2 HYDROGRAPHS AT A5 PLAN 2 RTIO 2

7.	7.	7.	7.	7.	7.	42.	152.	384.	730.
1127.	1520.	1875.	2186.	2453.	2695.	2919.	3121.	3292.	3436.
3553.	3651.	3732.	3799.	3866.	3949.	4064.	4212.	4370.	4520.
4648.	4748.	4819.	4871.	4911.	4974.	5067.	5182.	5312.	5536.
5930.	6710.	8200.	10731.	13884.	16822.	18785.	19644.	19461.	18451.
17000.	15592.	14277.	13075.	12053.	11170.	10418.	9780.	9269.	8846.
8474.	8132.	7797.	7464.	7145.	6848.	6587.	6367.	6193.	6052.
5934.	5834.	5709.	5510.	5178.	4710.	4173.	3624.	3111.	2663.
2300.	2003.	1743.	1516.	1318.	1161.	1050.	968.	908.	864.
832.	808.	791.	777.	767.	760.	754.	751.	748.	745.
743.	741.	739.	738.	735.	731.	726.	719.	712.	704.
696.	688.	679.	670.	662.	653.	644.	636.	628.	620.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	19644.	6903.	4405.	4405.	528560.
CMS	556.	195.	125.	125.	14967.
INCHES		16.46	17.51	17.51	17.51
MM		418.21	444.76	444.76	444.76
AC-FT		3423.	3640.	3640.	3640.
THOUS CU M		4222.	4490.	4490.	4490.

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HYDROGRAPH ROUTING

ROUTE HALEDON RES/SUB 1 TO INLET OF OLDHAM POND

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A6	1	0	0	0	0	1	0	0

ALL PLANS HAVE SAME
ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-1.	0

NORMAL DEPTH CHANNEL ROUTING

QN(1)	QN(2)	QN(3)	ELNVT	ELMAX	RLNTH	SEL
.0700	.0550	.0700	217.0	246.0	9000.	.01200

CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
0.00 246.00 16.00 230.00 73.00 219.00 74.00 217.00 79.00 217.00
80.00 219.00 87.00 220.00 160.00 246.00

STORAGE	0.00	.81	2.40	6.00	11.31	18.33	27.06	37.50	49.65	63.40
	76.09	93.59	109.90	127.03	144.98	163.74	183.31	203.70	224.91	246.92
OUTFLOW	0.00	26.89	102.87	295.56	643.10	1180.59	1940.54	2953.26	4247.35	5920.62
	7974.64	10326.56	12976.94	15928.05	19183.37	22747.15	26624.28	30820.06	35340.15	40195.42
STAGE	217.00	218.53	220.05	221.58	223.11	224.63	226.16	227.68	229.21	230.74
	232.26	233.79	235.32	236.84	238.37	239.89	241.42	242.95	244.47	246.00
FLOW	0.00	26.89	102.87	295.56	643.10	1180.59	1940.54	2953.26	4247.35	5920.62
	7974.64	10326.56	12976.94	15928.05	19183.37	22747.15	26624.28	30820.06	35340.15	40199.42

STATION A6, PLAN 1, RTIO 3

OUTFLOW

7.	7.	7.	7.	7.	7.	11.	29.	96.	239.
482.	812.	1101.	1573.	1917.	2244.	2526.	2774.	2993.	3192.
3354.	3487.	3597.	3688.	3765.	3842.	3930.	4042.	4175.	4327.
4479.	4608.	4712.	4790.	4850.	4905.	4973.	5062.	5171.	5321.
5564.	6019.	6979.	8650.	11201.	14226.	16922.	18685.	19357.	19044.
18030.	16697.	15360.	14106.	12959.	11932.	11133.	10391.	9794.	9288.
8857.	8477.	8125.	7796.	7476.	7164.	6874.	6616.	6398.	6219.
6072.	5950.	5842.	5705.	5492.	5168.	4739.	4243.	3773.	3298.
2866.	2508.	2190.	1912.	1683.	1479.	1306.	1170.	1073.	995.
934.	887.	850.	823.	802.	786.	774.	765.	758.	753.
749.	746.	744.	742.	739.	737.	734.	729.	724.	717.
710.	702.	694.	686.	678.	669.	661.	652.	644.	636.

STOR

0.	0.	0.	0.	0.	0.	0.	1.	2.	5.
9.	14.	18.	23.	27.	30.	33.	36.	38.	40.
41.	43.	44.	44.	45.	46.	47.	48.	49.	50.
52.	53.	53.	54.	55.	55.	56.	56.	57.	58.
60.	64.	71.	83.	99.	117.	133.	142.	146.	144.
139.	131.	124.	116.	110.	104.	99.	94.	90.	87.
84.	81.	79.	77.	75.	72.	70.	68.	67.	66.
64.	64.	63.	62.	60.	57.	54.	50.	45.	41.
37.	33.	30.	27.	24.	22.	20.	18.	17.	16.
15.	14.	14.	14.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	11.	11.	11.

STAGE

217.4	217.4	217.4	217.4	217.4	217.4	217.6	218.6	219.9	221.1
222.4	223.6	224.5	225.4	226.1	226.6	227.0	227.4	227.7	228.0
228.2	228.3	228.4	228.6	228.6	228.7	228.8	229.0	229.1	229.3

STATION A6, PLAN 2, RTIO 3

OUTFLOW

7.	7.	7.	7.	7.	7.	11.	29.	96.	239.
482.	812.	1181.	1573.	1917.	2244.	2526.	2774.	2993.	3192.
3354.	3487.	3597.	3688.	3765.	3842.	3930.	4042.	4175.	4327.
4479.	4608.	4712.	4790.	4850.	4905.	4973.	5062.	5171.	5321.
5564.	6019.	6979.	8658.	11201.	14226.	16922.	18685.	19357.	19044.
18030.	16697.	15360.	14106.	12959.	11992.	11133.	10391.	9794.	9288.
8857.	8477.	8125.	7796.	7476.	7164.	6874.	6616.	6398.	6219.
6072.	5950.	5842.	5705.	5492.	5168.	4739.	4243.	3773.	3298.
2866.	2508.	2190.	1912.	1683.	1479.	1306.	1170.	1073.	995.
934.	887.	850.	823.	802.	786.	774.	765.	758.	753.
749.	746.	744.	742.	739.	737.	734.	729.	724.	717.
710.	702.	694.	686.	678.	669.	661.	652.	644.	636.

STOR

0.	0.	0.	0.	0.	0.	0.	1.	2.	5.
9.	14.	18.	23.	27.	30.	33.	36.	38.	40.
41.	43.	44.	44.	45.	46.	47.	48.	49.	50.
52.	53.	53.	54.	55.	55.	56.	56.	57.	58.
60.	64.	71.	83.	99.	117.	133.	142.	146.	144.
139.	131.	124.	116.	110.	104.	99.	94.	90.	87.
84.	81.	79.	77.	75.	72.	70.	68.	67.	66.
64.	64.	63.	62.	60.	57.	54.	50.	45.	41.
37.	33.	30.	27.	24.	22.	20.	18.	17.	16.
15.	14.	14.	14.	13.	13.	13.	13.	13.	13.
13.	13.	13.	13.	13.	13.	12.	12.	12.	12.
12.	12.	12.	12.	12.	12.	12.	11.	11.	11.

STAGE

217.4	217.4	217.4	217.4	217.4	217.4	217.6	218.6	219.9	221.1
222.4	223.6	224.6	225.4	226.1	226.6	227.0	227.4	227.7	228.0
228.2	228.3	228.4	228.6	228.6	228.7	228.8	229.0	229.1	229.3
229.4	229.5	229.6	229.7	229.8	229.8	229.9	230.0	230.1	230.2
230.4	230.8	231.5	232.7	234.3	236.0	237.3	238.1	238.4	238.3
237.0	237.2	236.5	235.9	235.3	234.7	234.3	233.8	233.4	233.1

232.8	232.6	232.4	232.1	231.9	231.7	231.4	231.3	231.1	231.0
230.8	230.8	230.7	230.5	230.3	230.1	229.7	229.2	228.7	228.1
227.6	227.0	226.5	226.1	225.6	225.2	224.9	224.6	224.3	224.1
223.9	223.8	223.7	223.6	223.6	223.5	223.5	223.5	223.4	223.4
223.4	223.4	223.4	223.4	223.4	223.4	223.4	223.3	223.3	223.3
223.3	223.3	223.3	223.2	223.2	223.2	223.2	223.1	223.1	223.1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	19357.	6890.	4391.	4391.	526964.
CMS	548.	195.	124.	124.	14922.
INCHES		16.43	17.46	17.46	17.46
MM		417.44	443.41	443.41	443.41
AC-FT		3417.	3629.	3629.	3629.
THOUS CU M		4214.	4477.	4477.	4477.

MAXIMUM STORAGE = 146.

MAXIMUM STAGE IS 238.4

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SUB-AREA RUNOFF COMPUTATION

DEVELOP INFLOW HYDROGRAPH FOR SUB-BASIN TWO

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A7	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
0	2	1.40	0.00	1.40	.80	0.000	0	1	0

PRECIP DATA

NP	STORM	DAJ	DAK
72	0.00	0.00	0.00

PRECIP PATTERN

.21	.21	.21	.21	.21	.21	.21	.21	.21	.21
.21	.21	.25	.25	.25	.25	.25	.25	.25	.25
.25	.25	.25	.25	.31	.31	.31	.31	.31	.31
.31	.31	.31	.31	.31	.31	.19	.38	.38	.57
.66	1.60	2.64	1.04	.66	.57	.38	.30	.29	.29
.29	.29	.29	.29	.29	.29	.29	.29	.29	.29
.23	.23	.23	.23	.23	.23	.23	.23	.23	.23
.23	.23								

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.10	0.00	0.00

UNIT HYDROGRAPH DATA

TC= 0.00 LAG= .40

RECESSION DATA

STRTQ= -3.00 QRCSN= 0.00 RTIOR= 1.00

UNIT HYDROGRAPH 26 END OF PERIOD ORDINATES, TC= 0.00 HOURS, LAG= .40 VOL= 1.00

141.	433.	712.	1348.	1523.	1487.	1292.	1024.	787.	518.
387.	298.	209.	154.	113.	82.	61.	45.	33.	24.
18.	14.	11.	7.	4.	1.				

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.17	0.00	.17	4.	1.01	5.05	61	.18	.17	.01	2591.
1.01	.10	2	.17	0.00	.17	4.	1.01	5.10	62	.18	.17	.01	2522.
1.01	.15	3	.17	0.00	.17	4.	1.01	5.15	63	.18	.17	.01	2443.
1.01	.20	4	.17	0.00	.17	4.	1.01	5.20	64	.18	.17	.01	2352.
1.01	.25	5	.17	0.00	.17	4.	1.01	5.25	65	.18	.17	.01	2257.
1.01	.30	6	.17	0.00	.17	4.	1.01	5.30	66	.18	.17	.01	2166.
1.01	.35	7	.17	.15	.01	26.	1.01	5.35	67	.18	.17	.01	2088.
1.01	.40	8	.17	.16	.01	92.	1.01	5.40	68	.18	.17	.01	2026.
1.01	.45	9	.17	.16	.01	232.	1.01	5.45	69	.18	.17	.01	1985.
1.01	.50	10	.17	.16	.01	442.	1.01	5.50	70	.18	.17	.01	1956.
1.01	.55	11	.17	.16	.01	600.	1.01	5.55	71	.18	.17	.01	1936.
1.01	1.00	12	.17	.16	.01	914.	1.01	6.00	72	.18	.17	.01	1921.
1.01	1.05	13	.20	.19	.01	1123.	1.01	6.05	73	0.00	0.00	0.00	1886.
1.01	1.10	14	.20	.19	.01	1300.	1.01	6.10	74	0.00	0.00	0.00	1803.
1.01	1.15	15	.20	.19	.01	1443.	1.01	6.15	75	0.00	0.00	0.00	1639.
1.01	1.20	16	.20	.19	.01	1570.	1.01	6.20	76	0.00	0.00	0.00	1401.
1.01	1.25	17	.20	.19	.01	1682.	1.01	6.25	77	0.00	0.00	0.00	1135.
1.01	1.30	18	.20	.19	.01	1776.	1.01	6.30	78	0.00	0.00	0.00	875.
1.01	1.35	19	.20	.19	.01	1852.	1.01	6.35	79	0.00	0.00	0.00	649.
1.01	1.40	20	.20	.19	.01	1910.	1.01	6.40	80	0.00	0.00	0.00	471.
1.01	1.45	21	.20	.19	.01	1951.	1.01	6.45	81	0.00	0.00	0.00	347.
1.01	1.50	22	.20	.19	.01	1981.	1.01	6.50	82	0.00	0.00	0.00	257.
1.01	1.55	23	.20	.19	.01	2004.	1.01	6.55	83	0.00	0.00	0.00	189.
1.01	2.00	24	.20	.19	.01	2020.	1.01	7.00	84	0.00	0.00	0.00	139.
1.01	2.05	25	.25	.24	.01	2039.	1.01	7.05	85	0.00	0.00	0.00	103.
1.01	2.10	26	.25	.24	.01	2070.	1.01	7.10	86	0.00	0.00	0.00	76.
1.01	2.15	27	.25	.24	.01	2122.	1.01	7.15	87	0.00	0.00	0.00	56.
1.01	2.20	28	.25	.24	.01	2193.	1.01	7.20	88	0.00	0.00	0.00	42.
1.01	2.25	29	.25	.24	.01	2273.	1.01	7.25	89	0.00	0.00	0.00	32.
1.01	2.30	30	.25	.24	.01	2349.	1.01	7.30	90	0.00	0.00	0.00	24.
1.01	2.35	31	.25	.24	.01	2415.	1.01	7.35	91	0.00	0.00	0.00	18.
1.01	2.40	32	.25	.24	.01	2467.	1.01	7.40	92	0.00	0.00	0.00	14.
1.01	2.45	33	.25	.24	.01	2502.	1.01	7.45	93	0.00	0.00	0.00	11.
1.01	2.50	34	.25	.24	.01	2528.	1.01	7.50	94	0.00	0.00	0.00	8.
1.01	2.55	35	.25	.24	.01	2548.	1.01	7.55	95	0.00	0.00	0.00	6.
1.01	3.00	36	.25	.24	.01	2563.	1.01	8.00	96	0.00	0.00	0.00	5.
1.01	3.05	37	.15	.14	.01	2559.	1.01	8.05	97	0.00	0.00	0.00	4.
1.01	3.10	38	.30	.29	.01	2546.	1.01	8.10	98	0.00	0.00	0.00	4.
1.01	3.15	39	.30	.29	.01	2520.	1.01	8.15	99	0.00	0.00	0.00	4.
1.01	3.20	40	.45	.44	.01	2560.	1.01	8.20	100	0.00	0.00	0.00	4.
1.01	3.25	41	.53	.52	.01	2694.	1.01	8.25	101	0.00	0.00	0.00	4.
1.01	3.30	42	1.28	1.27	.01	3057.	1.01	8.30	102	0.00	0.00	0.00	4.
1.01	3.35	43	2.11	2.10	.01	3872.	1.01	8.35	103	0.00	0.00	0.00	4.
1.01	3.40	44	.83	.82	.01	5165.	1.01	8.40	104	0.00	0.00	0.00	4.
1.01	3.45	45	.53	.52	.01	6765.	1.01	8.45	105	0.00	0.00	0.00	4.
1.01	3.50	46	.45	.44	.01	8084.	1.01	8.50	106	0.00	0.00	0.00	4.
1.01	3.55	47	.30	.29	.01	8704.	1.01	8.55	107	0.00	0.00	0.00	4.
1.01	4.00	48	.30	.29	.01	8633.	1.01	9.00	108	0.00	0.00	0.00	4.
1.01	4.05	49	.23	.22	.01	8017.	1.01	9.05	109	0.00	0.00	0.00	4.
1.01	4.10	50	.23	.22	.01	7062.	1.01	9.10	110	0.00	0.00	0.00	4.
1.01	4.15	51	.23	.22	.01	6016.	1.01	9.15	111	0.00	0.00	0.00	4.
1.01	4.20	52	.23	.22	.01	5168.	1.01	9.20	112	0.00	0.00	0.00	4.

1.01	4.25	53	.23	.22	.01	4496.	1.01	9.25	113	0.00	0.00	0.00	4.
1.01	4.30	54	.23	.22	.01	3961.	1.01	9.30	114	0.00	0.00	0.00	4.
1.01	4.35	55	.23	.22	.01	3559.	1.01	9.35	115	0.00	0.00	0.00	4.
1.01	4.40	56	.23	.22	.01	3251.	1.01	9.40	116	0.00	0.00	0.00	4.
1.01	4.45	57	.23	.22	.01	3030.	1.01	9.45	117	0.00	0.00	0.00	4.
1.01	4.50	58	.23	.22	.01	2867.	1.01	9.50	118	0.00	0.00	0.00	4.
1.01	4.55	59	.23	.22	.01	2748.	1.01	9.55	119	0.00	0.00	0.00	4.
1.01	5.00	60	.23	.22	.01	2661.	1.01	10.00	120	0.00	0.00	0.00	4.
									SUM	19.83	18.26	1.55	198614.
										(504.)	(464.)	(39.)	(5624.12)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8704.	2738.	1655.	1655.	198616.
CMS	246.	78.	47.	47.	5624.
INCHES		18.19	18.33	18.33	18.33
MM		462.03	465.56	465.56	465.56
AC-FT		1357.	1368.	1368.	1368.
THOUS CU M		1674.	1687.	1687.	1687.

HYDROGRAPH AT STA A7 FOR PLAN 1, RTIO 3

4.	4.	4.	4.	4.	4.	26.	92.	232.	442.
680.	914.	1123.	1300.	1443.	1570.	1682.	1776.	1852.	1910.
1951.	1981.	2004.	2020.	2039.	2070.	2122.	2193.	2273.	2349.
2415.	2467.	2502.	2520.	2540.	2563.	2559.	2546.	2528.	2560.
2694.	3057.	3872.	5165.	6765.	8084.	8704.	8633.	8017.	7062.
6016.	5168.	4496.	3961.	3559.	3251.	3030.	2867.	2748.	2661.
2591.	2522.	2443.	2352.	2257.	2166.	2088.	2026.	1985.	1956.
1936.	1921.	1886.	1803.	1639.	1401.	1135.	875.	649.	471.
347.	257.	188.	139.	103.	76.	56.	42.	32.	24.
18.	14.	11.	8.	6.	5.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.
4.	4.	4.	4.	4.	4.	4.	4.	4.	4.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	8704.	2738.	1655.	1655.	198616.
CMS	246.	78.	47.	47.	5624.
INCHES		18.19	18.33	18.33	18.33
MM		462.03	465.56	465.56	465.56
AC-FT		1357.	1368.	1368.	1368.
THOUS CU M		1674.	1687.	1687.	1687.

PLAN 2: SAME AS PLAN 1

*********** *********** *********** *********** ***********

COMBINE HYDROGRAPHS

COMBINE ROUTED HALEDON RES/SUB 1 AND SUB 2

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
A8	2	0	0	0	0	1	0	0

SUM OF 2 HYDROGRAPHS AT AB PLAN 1 RTIO 3

11.	11.	11.	11.	11.	11.	36.	121.	329.	681.
1163.	1726.	2304.	2873.	3361.	3814.	4208.	4550.	4845.	5102.
5306.	5469.	5601.	5708.	5805.	5911.	6052.	6235.	6448.	6676.
6894.	7075.	7214.	7319.	7398.	7467.	7532.	7608.	7699.	7880.
8258.	9077.	10851.	13823.	17966.	22310.	25625.	27318.	27374.	26106.
24046.	21864.	19856.	18067.	16513.	15244.	14162.	13258.	12542.	11950.
11448.	10999.	10569.	10148.	9733.	9331.	8962.	8642.	8382.	8175.
8098.	7870.	7727.	7507.	7131.	6570.	5874.	5118.	4422.	3768.
3213.	2765.	2379.	2051.	1786.	1554.	1363.	1212.	1105.	1019.
952.	900.	861.	831.	808.	791.	778.	769.	763.	758.
754.	751.	748.	746.	744.	741.	738.	733.	728.	721.
714.	707.	699.	690.	682.	673.	665.	656.	648.	641.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	27374.	9600.	6046.	6046.	725579.
CMS	775.	272.	171.	171.	20546.
INCHES		16.85	17.69	17.69	17.69
MM		427.97	449.26	449.26	449.26
AC-FT		4760.	4997.	4997.	4997.
THOUS CU M		5872.	6164.	6164.	6164.

SUM OF 2 HYDROGRAPHS AT AB PLAN 2 RTIO 3

11.	11.	11.	11.	11.	11.	36.	121.	329.	681.
1163.	1726.	2304.	2873.	3361.	3814.	4208.	4550.	4845.	5102.
5306.	5469.	5601.	5708.	5805.	5911.	6052.	6235.	6448.	6676.
6894.	7075.	7214.	7319.	7398.	7467.	7532.	7608.	7699.	7880.
8258.	9077.	10851.	13823.	17966.	22310.	25625.	27318.	27374.	26106.
24046.	21864.	19856.	18067.	16513.	15244.	14162.	13258.	12542.	11950.
11448.	10999.	10569.	10148.	9733.	9331.	8962.	8642.	8382.	8175.
8098.	7870.	7727.	7507.	7131.	6570.	5874.	5118.	4422.	3768.
3213.	2765.	2379.	2051.	1786.	1554.	1363.	1212.	1105.	1019.
952.	900.	861.	831.	808.	791.	778.	769.	763.	758.
754.	751.	748.	746.	744.	741.	738.	733.	728.	721.
714.	707.	699.	690.	682.	673.	665.	656.	648.	641.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	27374.	9600.	6046.	6046.	725579.
CMS	775.	272.	171.	171.	20546.
INCHES		16.85	17.69	17.69	17.69
MM		427.97	449.26	449.26	449.26
AC-FT		4760.	4997.	4997.	4997.
THOUS CU M		5872.	6164.	6164.	6164.

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**********          **********          **********          **********          **********

                              HYDROGRAPH ROUTING

          ROUTE COMBINED HYDROGRAPH THROUGH OLDHAM POND

                  ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                     A9       1       0       0       0       0       1       0       0

                              ALL PLANS HAVE SAME
                                  ROUTING DATA
          QLOSS   CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
            0.0   0.000    0.00       1       1       0       0               0

                  NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                      1       0       0   0.000   0.000   0.000     77.      -1

STAGE     202.70    203.70    204.70    205.70    206.70    207.70    208.70    209.70

FLOW        0.00    103.00    745.00   1818.00   3179.00   7026.00  13297.00  21037.00

 CAPACITY=      0.       77.       95.      114.      133.      153.      174.      196.      218.

ELEVATION=    191.      203.      204.      205.      206.      207.      208.      209.      210.

                CREL   SPWID    COQW    EXPW   ELEVL    COQL   CAREA    EXPL
               202.7     0.0     0.0     0.0     0.0     0.0     0.0     0.0

                                        DAM DATA
                              TOPEL    COQD    EXPD   DAMWID
                              206.7     0.0     0.0       0.

                                     DAM BREACH DATA
                        BRWID       Z    ELBM   TFAIL    WSEL  FAILEL
                          30.    1.00   190.7    1.00  202.00  206.70

                              STATION     A9, PLAN 1, RATIO 1

BEGIN DAM FAILURE AT   3.92 HOURS

                              END-OF-PERIOD HYDROGRAPH ORDINATES
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OVN

STATION AP, PLAN 1, RATIO 3

BEGIN DAM FAILURE AT 1.50 HOURS

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	9.
44.	99.	479.	1016.	1700.	2397.	3010.	3898.	4615.	5079.
5419.	5686.	5904.	6086.	6350.	6714.	7000.	7262.	7570.	7875.
7343.	7191.	7172.	7212.	7273.	7340.	7415.	7495.	7577.	7687.
7884.	8290.	9163.	10937.	14946.	20179.	24267.	26822.	27429.	26670.
24829.	22740.	20734.	18844.	17189.	15897.	14891.	13842.	13011.	12337.
11776.	11397.	11049.	10659.	10254.	9848.	9455.	9104.	8794.	8525.
8300.	8113.	7950.	7778.	7541.	7219.	6800.	6257.	5727.	5264.
4487.	3702.	3145.	2712.	2360.	2069.	1823.	1616.	1446.	1309.
1197.	1106.	1033.	973.	925.	886.	855.	831.	811.	796.
784.	773.	767.	761.	757.	752.	749.	745.	741.	736.
731.	725.	719.	712.	704.	697.	689.	681.	673.	665.

STORAGE

73.	73.	73.	73.	73.	73.	73.	74.	75.	79.
85.	94.	106.	119.	131.	142.	151.	157.	160.	161.
160.	159.	157.	155.	152.	147.	141.	134.	127.	119.
114.	112.	111.	112.	113.	114.	114.	115.	116.	117.
119.	123.	132.	147.	168.	185.	197.	204.	205.	203.
199.	193.	187.	181.	176.	172.	167.	163.	159.	156.
154.	151.	148.	145.	141.	138.	134.	131.	128.	125.
123.	121.	120.	118.	116.	112.	107.	99.	91.	81.
72.	64.	58.	53.	49.	45.	42.	39.	37.	34.
33.	31.	30.	29.	28.	27.	26.	26.	26.	25.
25.	25.	25.	25.	24.	24.	24.	24.	24.	24.
24.	24.	24.	24.	23.	23.	23.	23.	23.	23.

STAGE

202.0	202.0	202.0	202.0	202.1	202.1	202.1	202.2	202.4	202.8
203.1	203.7	204.3	205.0	205.6	206.1	206.6	206.9	207.0	207.1
207.0	207.0	206.9	206.8	206.6	206.4	206.1	205.8	205.4	205.0
204.7	204.6	204.6	204.6	204.6	204.7	204.7	204.8	204.8	204.9
205.0	205.2	205.6	206.4	207.4	208.2	208.8	209.1	209.1	209.0
208.8	208.6	208.3	208.0	207.8	207.6	207.4	207.2	207.0	206.9
206.7	206.6	206.5	206.3	206.1	205.9	205.8	205.6	205.4	205.3
205.2	205.1	205.0	204.9	204.8	204.6	204.3	203.9	203.5	202.9
201.9	200.7	199.8	199.0	198.4	197.8	197.3	196.8	196.4	196.1
195.8	195.5	195.3	195.2	195.0	194.9	194.8	194.7	194.7	194.6
194.6	194.6	194.5	194.5	194.5	194.5	194.5	194.5	194.5	194.4
194.4	194.4	194.4	194.4	194.3	194.3	194.3	194.3	194.2	194.2

PEAK OUTFLOW IS 27429. AT TIME 4.08 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	27429.	9742.	6107.	6107.	732851.
CMS	777.	276.	173.	173.	20752.
INCHES		17.10	17.86	17.86	17.86
MM		434.31	453.77	453.77	453.77
AC-FT		4831.	5047.	5047.	5047.
THOUS CU M		5959.	6226.	6226.	6226.

THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF .021 HOURS DURING BREACH FORMATION.
DOWNSTREAM CALCULATIONS WILL USE A TIME INTERVAL OF .083 HOURS.
THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSTREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH.
INTERMEDIATE FLOWS ARE INTERPOLATED FROM END-OF-PERIOD VALUES.

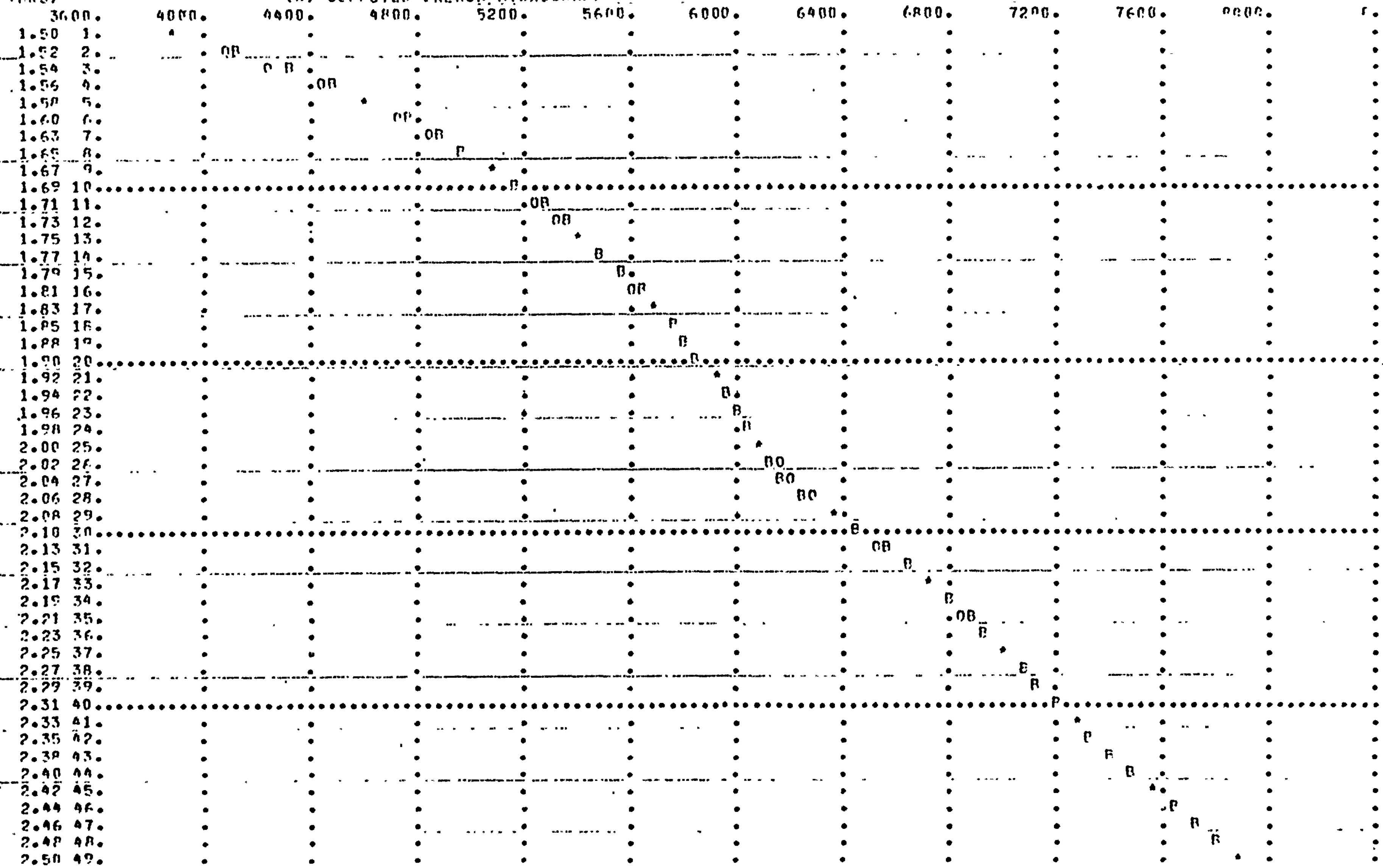
TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	-	COMPUTED BREACH HYDROGRAPH (CFS)	=	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
1.500	0.000	3898.		3898.		0.	0.	0.
1.521	.021	4077.		4113.		-36.	-36.	-0.
1.542	.042	4256.		4302.		-45.	-82.	-0.
1.563	.063	4436.		4468.		-32.	-114.	-0.
1.583	.083	4615.		4615.		0.	-114.	-0.
1.604	.104	4731.		4748.		-16.	-130.	-0.
1.625	.125	4847.		4867.		-20.	-150.	-0.
1.646	.146	4963.		4976.		-14.	-164.	-0.
1.667	.167	5079.		5079.		0.	-164.	-0.
1.688	.188	5164.		5173.		-9.	-173.	-0.
1.708	.208	5249.		5260.		-11.	-185.	-0.
1.729	.229	5334.		5342.		-8.	-192.	-0.
1.750	.250	5419.		5419.		0.	-192.	-0.
1.771	.271	5486.		5492.		-6.	-198.	-0.
1.792	.292	5553.		5560.		-7.	-206.	-0.
1.813	.313	5620.		5625.		-5.	-211.	-0.
1.833	.333	5686.		5686.		0.	-211.	-0.
1.854	.354	5741.		5745.		-4.	-215.	-0.
1.875	.375	5795.		5800.		-5.	-220.	-0.
1.896	.396	5850.		5853.		-3.	-223.	-0.
1.917	.417	5904.		5904.		0.	-223.	-0.
1.938	.438	5950.		5953.		-3.	-227.	-0.
1.958	.458	5995.		5999.		-4.	-231.	-0.
1.979	.479	6041.		6043.		-3.	-233.	-0.
2.000	.500	6086.		6086.		0.	-233.	-0.
2.021	.521	6152.		6127.		25.	-209.	-0.
2.042	.542	6218.		6168.		51.	-158.	-0.
2.063	.563	6284.		6237.		47.	-111.	-0.
2.083	.583	6350.		6350.		0.	-111.	-0.
2.104	.604	6441.		6452.		-11.	-122.	-0.
2.125	.625	6532.		6546.		-14.	-136.	-0.
2.146	.646	6623.		6633.		-10.	-147.	-0.
2.167	.667	6714.		6714.		0.	-147.	-0.
2.188	.688	6785.		6790.		-4.	-151.	-0.
2.208	.708	6857.		6862.		-6.	-157.	-0.
2.229	.729	6928.		6932.		-4.	-160.	-0.
2.250	.750	7000.		7000.		0.	-160.	-0.
2.271	.771	7065.		7066.		-1.	-161.	-0.
2.292	.792	7131.		7132.		-1.	-162.	-0.
2.313	.812	7196.		7197.		-1.	-163.	-0.
2.333	.833	7262.		7262.		0.	-163.	-0.
2.354	.854	7339.		7331.		8.	-155.	-0.
2.375	.875	7416.		7412.		4.	-151.	-0.
2.396	.896	7493.		7492.		1.	-150.	-0.
2.417	.917	7570.		7570.		0.	-150.	-0.
2.438	.937	7646.		7647.		-1.	-151.	-0.
2.458	.958	7722.		7724.		-1.	-152.	-0.
2.479	.979	7799.		7799.		-1.	-153.	-0.
2.500	1.000	7875.		7875.		0.	-153.	-0.

OVF

STATION A?

(O) INTERPOLATED BREACH HYDROGRAPH
(B) COMPUTED BREACH HYDROGRAPH

(*) POINTS AT NORMAL TIME INTERVAL



DAM BREACH DATA

BRWID	Z	ELBM	TFAIL	WSEL	FAILEL
50.	.50	190.79	1.00	202.00	230.00

STATION AP, PLAN 2, RATIO 3

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	9.
44.	99.	475.	1016.	1700.	2397.	3010.	3893.	4515.	4870.
5128.	5328.	5485.	5613.	5721.	5825.	5943.	6098.	6286.	6500.
6721.	6925.	7114.	7265.	7357.	7432.	7499.	7570.	7653.	7789.
8067.	8661.	9952.	12315.	16132.	20521.	24297.	26679.	27410.	26676.
24923.	22767.	20678.	18797.	17196.	15757.	14602.	13625.	12875.	12252.
11704.	11228.	10790.	10364.	9946.	9537.	9151.	8806.	8515.	8281.
8083.	7941.	7800.	7619.	7322.	6892.	6373.	5694.	4979.	4295.
3673.	3162.	2938.	2663.	2381.	2111.	1863.	1669.	1503.	1359.
1238.	1136.	1053.	986.	932.	889.	855.	828.	808.	792.
780.	771.	764.	758.	754.	750.	747.	744.	741.	738.
733.	729.	723.	717.	711.	704.	697.	689.	681.	674.

STORAGE

73.	73.	73.	73.	73.	73.	73.	74.	75.	79.
85.	94.	106.	119.	131.	142.	151.	157.	160.	162.
164.	165.	166.	166.	167.	167.	168.	169.	170.	171.
172.	173.	174.	175.	175.	175.	176.	176.	176.	177.
178.	180.	184.	193.	204.	217.	227.	234.	236.	234.
229.	223.	217.	212.	207.	203.	200.	197.	195.	192.
190.	189.	187.	186.	184.	183.	181.	180.	179.	178.
178.	177.	177.	176.	175.	173.	170.	167.	163.	159.
156.	153.	149.	145.	141.	137.	134.	130.	127.	125.
123.	121.	119.	118.	117.	117.	116.	115.	115.	115.
115.	114.	114.	114.	114.	114.	114.	114.	114.	114.
114.	114.	113.	113.	113.	113.	113.	112.	112.	112.

STAGE

202.0	202.0	202.0	202.0	202.1	202.1	202.1	202.2	202.4	202.6
203.1	203.7	204.3	205.0	205.6	206.1	206.6	206.9	207.0	207.1
207.2	207.3	207.3	207.3	207.4	207.4	207.4	207.5	207.5	207.6
207.6	207.7	207.7	207.7	207.8	207.8	207.8	207.8	207.8	207.8
207.9	208.0	208.2	208.5	209.1	209.6	210.1	210.4	210.5	210.4
210.2	209.9	209.7	209.4	209.2	209.0	208.9	208.7	208.6	208.5
208.4	208.4	208.3	208.2	208.2	208.1	208.0	208.0	207.9	207.9
207.9	207.8	207.8	207.8	207.7	207.7	207.5	207.4	207.2	207.0
206.8	206.7	206.5	206.3	206.1	205.9	205.7	205.6	205.4	205.3
205.2	205.1	205.0	204.9	204.9	204.8	204.8	204.8	204.8	204.7
204.7	204.7	204.7	204.7	204.7	204.7	204.7	204.7	204.7	204.7
204.7	204.7	204.7	204.7	204.6	204.6	204.6	204.6	204.6	204.6

PEAK OUTFLOW IS 27410. AT TIME 4.08 HOURS

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	27410.	9557.	5999.	5999.	719855.
CMS	776.	271.	170.	170.	20384.
INCHES		16.77	17.55	17.55	17.55
MM		426.06	445.72	445.72	445.72
AC-FT		4739.	4958.	4958.	4958.
THOUS CU M		5846.	6115.	6115.	6115.

```
          **********          **********          **********          **********          **********

                                             HYDROGRAPH ROUTING

                ROUTE OUTFLOW FROM OLDHAM POND DOWNSTREAM

                              ISTAQ   ICOMP   IECON   ITAPE    JPLT    JPRT   INAME  ISTAGE   IAUTO
                               A10        1       0       0       0       0       1       0       0

                                           ALL PLANS HAVE SAME
                                              ROUTING DATA
                        QLOSS    CLOSS     AVG    IRES   ISAME    IOPT    IPMP            LSTR
                          0.0    0.000    0.00       1       1       0       0               0

                                 NSTPS   NSTDL     LAG   AMSKK       X     TSK   STORA  ISPRAT
                                     1       0       0   0.000   0.000   0.000     -1.       0

NORMAL DEPTH CHANNEL ROUTING
----------------------------

       QN(1)   QN(2)   QN(3)   ELNVT   ELMAX   RLNTH     SEL
       .0700   .0550   .0700   182.0   215.0    600.  .03330

       CROSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC
             0.00  215.00   10.00  190.00   30.00  190.00   34.00  182.00   36.00  182.00
            42.00  196.00   90.00  196.00   95.00  215.00

STORAGE         0.00       .07       .17       .32       .50       .91      1.64      2.41      3.22      5.13
                7.14      9.18     11.25     13.34     15.46     17.61     19.79     21.99     24.22     26.48

OUTFLOW         0.00     21.38     73.85    162.55    293.88    524.66   1063.93   1822.94   2761.23   4340.74
             6613.22   9400.43  12626.76  16243.85  20217.13  24520.40  29133.06  34038.53  39223.24  44675.91

STAGE         182.00    183.74    185.47    187.21    188.95    190.68    192.42    194.16    195.89    197.63
              199.37    201.11    202.84    204.58    206.32    208.05    209.79    211.53    213.26    215.00

FLOW            0.00     21.38     73.85    162.55    293.88    524.66   1063.93   1822.94   2761.23   4340.74
             6613.22   9400.43  12626.76  16243.85  20217.13  24520.40  29133.06  34038.53  39223.24  44675.91
```

STATION A10, PLAN 1, RTIO 3

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	5.
29.	83.	366.	899.	1595.	2313.	2925.	3707.	4533.	5032.
5377.	5657.	5877.	6065.	6309.	6566.	6981.	7228.	7538.	7842.
7457.	7144.	7206.	7182.	7281.	7323.	7413.	7482.	7571.	7671.
7860.	8235.	9046.	10732.	14486.	19792.	24034.	26688.	27458.	26704.
24989.	22882.	20882.	18983.	17309.	15986.	14930.	13922.	13073.	12393.
11825.	11422.	11086.	10695.	10293.	9885.	9491.	9140.	8825.	8553.
8322.	8131.	7967.	7798.	7570.	7257.	6849.	6331.	5792.	5320.
4613.	3827.	3230.	2704.	2385.	2110.	1847.	1649.	1467.	1329.
1212.	1119.	1044.	985.	973.	893.	861.	835.	815.	799.
786.	777.	769.	763.	757.	753.	749.	746.	742.	737.
732.	726.	720.	713.	706.	698.	691.	683.	675.	667.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	2.	3.	3.	4.	5.	6.
6.	6.	6.	7.	7.	7.	7.	8.	8.	8.
8.	8.	8.	8.	8.	8.	8.	8.	8.	8.
8.	8.	9.	10.	12.	15.	17.	19.	19.	19.
18.	17.	16.	15.	14.	13.	13.	12.	12.	11.
11.	10.	10.	10.	10.	9.	9.	9.	9.	9.
8.	8.	8.	8.	8.	8.	7.	7.	6.	5.
5.	5.	4.	3.	3.	3.	2.	2.	2.	2.
2.	2.	2.	2.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

STAGE

182.0	182.0	182.0	182.0	182.0	182.0	182.0	182.0	182.0	182.4
184.0	185.7	189.5	191.9	193.6	195.1	196.1	196.9	197.8	198.2
196.4	198.6	198.8	198.9	199.1	199.4	199.6	199.8	199.9	200.1
199.9	199.7	199.7	199.7	199.8	199.8	199.9	199.9	200.0	200.0
200.1	200.4	200.9	201.8	203.7	206.1	207.9	208.9	209.2	208.9
208.2	207.4	206.6	205.8	205.0	204.5	203.9	203.5	203.1	202.7
202.4	202.2	202.0	201.8	201.6	201.4	201.2	200.9	200.7	200.6
200.4	200.3	200.2	200.1	200.0	199.8	199.5	199.2	198.7	198.4
197.8	197.1	196.4	195.9	195.2	194.7	194.2	193.8	193.3	193.0
192.8	192.5	192.4	192.2	192.0	191.9	191.8	191.7	191.6	191.6
191.5	191.5	191.5	191.5	191.4	191.4	191.4	191.4	191.4	191.4
191.4	191.3	191.3	191.3	191.3	191.2	191.2	191.2	191.2	191.1

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	27458.	9742.	6106.	6106.	732691.
CMS	778.	276.	173.	173.	20748.
INCHES		17.10	17.86	17.86	17.86
MM		434.29	453.67	453.67	453.67
AC-FT		4831.	5046.	5046.	5046.
THOUS CU M		5958.	6224.	6224.	6224.

MAXIMUM STORAGE = 19.

MAXIMUM STAGE IS 209.2

STATION A10, PLAN 2, RTIO 3

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	5.
29.	83.	366.	899.	1595.	2313.	2925.	3704.	4452.	4835.
5096.	5307.	5466.	5598.	5708.	5811.	5927.	6076.	6261.	6471.
6695.	6905.	7093.	7252.	7350.	7424.	7492.	7562.	7644.	7771.
8029.	8581.	9786.	12058.	15757.	20201.	24058.	26571.	27404.	26760.
25064.	22931.	20829.	18941.	17263.	15862.	14694.	13700.	12929.	12308.
11751.	11270.	10839.	10404.	9984.	9575.	9190.	8841.	8543.	8304.
8112.	7956.	7815.	7641.	7360.	6943.	6438.	5795.	5066.	4384.
3789.	3239.	2859.	2722.	2402.	2152.	1888.	1698.	1525.	1380.
1254.	1150.	1064.	1000.	941.	897.	861.	833.	812.	795.
783.	773.	765.	759.	755.	751.	747.	744.	742.	738.
734.	730.	724.	718.	712.	705.	698.	691.	687.	675.

STOR

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	1.	1.	2.	3.	3.	4.	5.	6.
6.	6.	6.	6.	6.	6.	7.	7.	7.	7.
7.	7.	7.	8.	8.	8.	8.	8.	8.	8.
8.	9.	9.	11.	13.	15.	17.	19.	19.	19.
18.	17.	16.	15.	14.	13.	12.	12.	11.	11.
11.	10.	10.	10.	10.	9.	9.	9.	9.	8.
8.	8.	8.	8.	8.	7.	7.	6.	6.	5.
4.	4.	3.	3.	3.	3.	2.	2.	2.	2.
2.	2.	2.	2.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.
1.	1.	1.	1.	1.	1.	1.	1.	1.	1.

STAGE

182.0	182.0	182.0	182.0	182.0	182.0	182.0	182.0	182.0	182.4
184.0	185.7	189.5	191.9	193.6	195.1	196.1	196.9	197.7	198.0
198.2	198.4	198.5	198.6	198.7	198.8	198.8	199.0	199.1	199.3
199.4	199.6	199.7	199.8	199.8	199.9	199.9	200.0	200.0	200.1
200.3	200.6	201.3	202.5	204.3	206.3	207.9	208.8	209.1	208.9
208.3	207.4	206.6	205.8	205.0	204.4	203.8	203.4	203.0	202.7
202.4	202.1	201.9	201.6	201.4	201.2	201.0	200.8	200.6	200.4
200.3	200.2	200.1	200.0	199.8	199.6	199.2	198.7	198.2	197.7
197.0	196.4	196.1	195.8	195.2	194.8	194.3	193.9	193.5	193.1
192.9	192.6	192.4	192.2	192.0	191.9	191.8	191.7	191.6	191.6
191.5	191.5	191.5	191.4	191.4	191.4	191.4	191.4	191.4	191.4
191.4	191.3	191.3	191.3	191.3	191.3	191.2	191.2	191.2	191.2

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	27404.	9556.	5997.	5997.	719693.
CMS	776.	271.	170.	170.	20379.
INCHES		16.77	17.54	17.54	17.54
MM		426.04	445.62	445.62	445.62
AC-FT		4739.	4957.	4957.	4957.
THOUS CU M		5845.	6114.	6114.	6114.

MAXIMUM STORAGE = 19.

MAXIMUM STAGE IS 209.1

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS RATIO 1 .20	RATIO 2 .50	RATIO 3 1.00
HYDROGRAPH AT	A1	1.60	1	2300.	5750.	11500.
		(4.14)		(65.13)(	162.82)(	325.63)(
			2	2300.	5750.	11500.
				(65.13)(	162.82)(	325.63)(
ROUTED TO	A2	1.60	1	596.	2187.	7666.
		(4.14)		(16.87)(	61.92)(	217.07)(
			2	596.	2187.	7666.
				(16.87)(	61.92)(	217.07)(
ROUTED TO	A3	1.60	1	592.	2016.	7117.
		(4.14)		(16.76)(	57.09)(	201.52)(
			2	592.	2016.	7117.
				(16.76)(	57.09)(	201.52)(
HYDROGRAPH AT	A4	2.30	1	2860.	7149.	14299.
		(5.96)		(80.98)(	202.45)(	404.90)(
			2	2860.	7149.	14299.
				(80.98)(	202.45)(	404.90)(
2 COMBINED	A5	3.90	1	3246.	7886.	19644.
		(10.10)		(91.92)(	223.30)(	556.26)(
			2	3246.	7886.	19644.
				(91.92)(	223.30)(	556.26)(
ROUTED TO	A6	3.90	1	3077.	7677.	19357.
		(10.10)		(87.12)(	217.40)(	548.13)(
			2	3077.	7677.	19357.
				(87.12)(	217.40)(	548.13)(
HYDROGRAPH AT	A7	1.40	1	1741.	4352.	8704.
		(3.63)		(49.29)(	123.23)(	246.46)(
			2	1741.	4352.	8704.
				(49.29)(	123.23)(	246.46)(
2 COMBINED	A8	5.30	1	4704.	11891.	27374.
		(13.73)		(133.20)(	336.72)(	775.15)(
			2	4704.	11891.	27374.
				(133.20)(	336.72)(	775.15)(
ROUTED TO	A9	5.30	1	4814.	11297.	27429.
		(13.73)		(136.33)(	319.91)(	776.72)(
			2	4607.	11786.	27410.
				(130.46)(	333.74)(	776.15)(
ROUTED TO	A10	5.30	1	4807.	11329.	27458.
		(13.73)		(136.12)(	320.79)(	777.53)(
			2	4631.	11814.	27404.
				(131.15)(	334.53)(	776.00)(

43

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	412.00	412.00	416.06
STORAGE	657.	657.	978.
OUTFLOW	0.	0.	750.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	414.26	0.00	817.	596.	0.00	4.83	0.00
.50	416.66	.60	1046.	2187.	2.67	4.33	0.00
1.00	418.28	2.22	1238.	7666.	4.17	4.08	0.00

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	412.00	412.00	416.06
STORAGE	657.	657.	978.
OUTFLOW	0.	0.	750.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	414.26	0.00	817.	596.	0.00	4.83	0.00
.50	416.66	.60	1046.	2187.	2.67	4.33	0.00
1.00	418.28	2.22	1238.	7666.	4.17	4.08	0.00

PLAN 1 STATION A3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	592.	324.1	5.33
.50	2016.	326.7	4.67
1.00	7117.	330.8	4.25

PLAN 2 STATION A3

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	592.	324.1	5.33
.50	2016.	326.7	4.67
1.00	7117.	330.8	4.25

PLAN 1 STATION A6

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	3077.	227.8	4.00
.50	7677.	232.0	4.00

1.00	19357.	238.4	4.00

PLAN 2 STATION A6

RATIO	MAXIMUM FLOW.CFS	MAXIMUM STAGE.FT	TIME HOURS
.20	3077.	227.8	4.00
.50	7677.	232.0	4.00
1.00	19357.	238.4	4.00

15

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	202.00	202.70	206.70
STORAGE	73.	77.	153.
OUTFLOW	0.	0.	3179.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	206.99	.29	159.	4840.	.42	4.13	3.92
.50	206.76	.06	154.	11297.	.31	4.17	2.58
1.00	209.12	2.42	205.	27429.	2.00	4.08	1.50

PLAN 2 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	202.00	202.70	206.70
STORAGE	73.	77.	153.
OUTFLOW	0.	0.	3179.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	207.07	.37	161.	4607.	.67	4.08	0.00
.50	208.46	1.76	191.	11786.	3.92	4.08	0.00
1.00	210.52	3.82	236.	27410.	5.33	4.08	0.00

PLAN 1 STATION A10

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	4807.	198.0	4.08
.50	11329.	202.1	4.17
1.00	27458.	209.2	4.08

PLAN 2 STATION A10

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	4631.	197.9	4.08
.50	11814.	202.4	4.08
1.00	27404.	209.1	4.08

APPENDIX 4

ENGINEERING DATA

OLDHAM POND DAM

Report on Dam Inspection

OLDHAM POND

MARIETTA-HARMON CHEMICALS, INC.

MOLLY ANN BROOK, PASSAIC COUNTY

APPLICATION NO. 400

DAM NO. 23-13

On July 27, 1945, during a general inspection of the July 23 flood damage on Molly Ann Brook, the dam at Oldham Pond in North Haledon was inspected to note extent of damage and to obtain high water marks for estimating flood peak discharge.

During the inspection John Becker, contractor, was encountered while he was making a survey of necessary repairs for the owners, Marietta-Harmon Chemicals, Inc., 550 Belmont Avenue, Haledon, N. J. Mr. Becker was advised to notify the owners that application accompanied by drawings would be required because of the washout in the raceway and the damage to the left spillway. The extent of the necessary repairs was discussed with Mr. Becker and a copy of the dam booklet, together with application blanks, were left with him for the owners.

On August 2 another inspection of this dam was made at the request of Mr. Paul Miller of the Marietta-Harmon Chemicals, Inc. This inspection was made in company with Mr. Paul Miller, Water Supply Engineer, Amos Miller, Plant Engineer, H. T. Madden, Vice-President and Plant Supt. and Messrs. Becker and Brucker, contractors, to decide the extent of repairs to be made. This inspection disclosed that Oldham Pond is used as an industrial water supply by the owners to supplement a well located at the site of the plant. The supply is treated in several basins located on the overflow channel from the stilling pond at the end of the raceway. Mr. Paul Miller advised that the raceway would be abandoned and replaced by a 16-inch intake pipe line from the pond to the treatment basins.

On August 7 further conference was held in Trenton with Messrs. H. T. Madden and Amos Miller after preliminary examination had been completed to determine the height to which walls and the dam embankment should be raised.

On August 13 application accompanied by drawings showing the repairs agreed upon at the August 7 conference were filed.

On August 21 an inspection was made at the request of the applicant to approve the foundation for the cutoff wall at the inlet of the raceway. This inspection was made in company with Amos Miller. Since the inspection disclosed a tight dense clay, permission was granted to place concrete. At

that time, Mr. Miller was requested to amplify his drawings to include raising the retaining wall along Church Street. At the August 7 conference, this wall was thought to be the property of Passaic County.

The results of these inspections have been indicated in red pencil on copies of the Riparian Stream Surveys of Molly Ann Brook at Oldham Pond. It will be noted that while the main dam was slightly overtopped at points by the July 23 flood, no appreciable damage was suffered by any of the three spillways or the high part of the embankment. The control works at the raceway were washed out and a large hole was torn in the left dike of the raceway at the control gates, located some 250 feet below the intake. The washout in the raceway released flood waters, which damaged the old flocculating basins of the Harmon company, located between the raceway and the main channel upstream of the plant. It is believed that heavy surface run-off from the west mountainside was as much responsible, if not more, for the washout in this raceway as the flood height in Oldham Pond. At the opposite end of the dam a retaining wall along the spillway overflow channel was overturned and washed out by the return of flood overflow from Oldham Pond into Church Street back into the natural channel of Molly Ann Brook. The flood level in Oldham Pond, as determined by a series of readings and later checked by Mr. Paul Miller, is at elevation 205.7. Mr. Miller was out during this storm with a force of men keeping debris off the wire fence across the right and center spillways. Mr. Miller reports that the heaviest part of the storm occurred between 11:00 p.m. and 1:30 a.m. on the 23rd, with a flood peak at 4:00 a.m. The pond level before the July 23 flood was 4 inches below the low point in the right spillway. The pond had been drawn down intentionally after the July 18-19 flood to provide additional safety against failure of the upper dams, which had been weakened by that flood. The high water for the July 18-19 flood was reported by Mr. Paul Miller at elevation 205.1.

The general flood problem on Molly Ann Brook was discussed with Messrs. Paul Miller and H. T. Madden. Mr. Miller offered to provide an observer for the operation of a stream gaging station at this dam. Mr. Madden stated that his company would be willing to cooperate in any general program and that they would be interested in having an encroachment line established through their property between the dam and Church Street.

Seven copies of the stream surveys, giving the details of the dam and of the stream through the plant, were purchased by Mr. Madden.

George R. Shanklin
George R. Shanklin
Asst. Chief Engineer

Trenton, New Jersey
September 19, 1945

9/20/45

Report on Dam Inspection

OLDHAM POND

MARIETTA-HARMON CHEMICALS, INC.

MOLLY ANN BROOK, PASSAIC COUNTY

APPLICATION NO. 400

DAM NO. 23-13

On September 26, 1945 progress inspection was made of the repairs to Oldham Pond dam, approved for the Marietta-Harmon Chemicals, Inc. under the above application on September 6, 1945.

At the time of the inspection the pond level was 5 inches below the spillway crest of the right spillway, as measured at the right abutment. If the elevation of this crest is taken at elevation 202.35, the water level at the time of the inspection was at elevation 201.9.

The inspection disclosed that the cutoff wall at the inlet of the raceway has been completed, that the addition to the old wall along the dam embankment from the raceway to the right end of the right spillway has been finished, that the pipe posts and fence have been removed from the right and center spillways and that the retaining wall along Church Street on the left side of the pond has been raised to proper grade. The top of wall at the raceway to the right of the right spillway and along Church Street was 4'7" above the water level or at elevation 206.6, as compared with the approved top of wall elevation 206.5. A temporary timber driveway bridge has been constructed across the spillway channel at the left spillway for construction purposes.

George R. Shanklin

Trenton, New Jersey
October 1, 1945

George R. Shanklin
Asst. Chief Engineer

Report on Dam Inspection

OLDHAM POND

MOLLY ANN BROOK, PASSAIC COUNTY

APPLICATION NO. 400

DAM NO. 23-13

On February 25, 1946, in the company of Amos Miller, Plant Engineer, Marietta-Harmon Chemicals, Inc. and Carl R. Blanche, final inspection was made of the repairs to a dam known as Oldham Pond in North Haledon on Molly Ann Brook, approved September 6, 1945.

The inspection disclosed that the work had been completed in accordance with approved drawings and that the temporary bridge across the left spillway had been removed. The earth embankment back of the wall along the upstream face of the dam embankment has been raised to and slightly above the top of the masonry wall.

It is recommended that the dam be accepted.

At the time of the inspection the pond was full and frozen over. One photograph was taken.

George R. Shanklin
George R. Shanklin
Asst. Chief Engineer

Trenton, New Jersey
February 26, 1946

December 13, 1949

Mr. Amos Miller
Harmon Color Works, Inc.
550 Belmont Avenue
Haledon, New Jersey

Re: Dam Application No. 400

Dear Mr. Miller:

At your request an inspection of the dam at Oldham Pond, on Molly Ann Brook in North Haledon, was recently made by an engineering representative of this Division. As a result of this inspection we are pleased to report that generally speaking all structures pertaining to the dam are in excellent condition. However, there are two minor repairs which we recommend should be attended to at the earliest opportunity. These are as follows:

(1) A horizontal crack, several feet long, in the concrete was noticed just below the crest of the westerly spillway near its easterly end. This crack should be filled in with cement grout in order to prevent damage to the concrete by freezing.

(2) A considerable amount of stone masonry has fallen out of the retaining wall along the downstream face of the dam embankment, a short distance east of the westerly spillway. While this condition does not constitute a threat to the safety of the structure, it should be repaired.

Yours very truly,

H. T. Critchlow
Director and Chief Engineer

HCW:LMS

5

NAW

Report on Dam Inspection

OLDHAM POND

MOLLY ANN BROOK, PASSAIC COUNTY

APPLICATION NO. 400

On December 7, 1949 inspection was made of the subject dam at the request of Mr. Amos Miller, Chemist for the Harmon Color Works, Inc., owner of the dam.

The inspection disclosed that the pond level was approximately 15 feet below the spillway crest and that the structure is in excellent physical condition with two minor exceptions. (1) A horizontal crack was visible about 8 inches below the crest of the right or west spillway, a few feet from the left end of the spillway. This crack was 4 or 5 feet long. In order to prevent damage by freezing, this crack should be filled in with cement grout. (2) The stone masonry has fallen out of a short section of the downstream retaining wall of the dam, immediately east of the west spillway. This masonry should be replaced, although this condition does not constitute a serious threat to the safety of the structure.

N C Wittwer

Norman C. Wittwer
Principal Hydraulic Engineer

December 13, 1949

5

Report on Inspection

HARMON COLOR WORKS DAM
(B. F. GOODRICH CHEMICAL COMPANY)
Dam 23-1?, Application 400

On Thursday, March 10, 1955 the undersigned made an inspection of the dam and headworks owned by the B. F. Goodrich Chemical Company on Molly Ann Brook in the Borough of North Haledon, Passaic County. The inspection was made at the request of Mr. W. J. Pratt, Plant Engineer, to determine what steps were necessary to maintain the dam in first class condition. The inspection was made in company with Mr. August Posch. of Mr. Pratt's staff.

The dam is in generally good condition. Except for a localized area of mortar spalling on the downstream face of the main spillway. The condition of the masonry was very good. Mr. Posch pointed out that maintenance work was done each year on obvious damage, and that the spalling had resulted from the previous seasonal freezing. Black willows were growing immediately upstream of the paved crest of the large auxiliary spillway in the center of the dam. It was suggested that a chemical weed killer be used to destroy these, which would obstruct the spillway considerably if control was attempted by cutting back to the stump regularly.

Other than the above, there is nothing worthy of comment to the owners.

William E. Edens
Senior Engineer

7/50

March 14, 1955

Report on Dam Inspection

Oldham Pond Dam
Dam Approval No. 400
Molly Ann Brook, Trib. Passaic River
Haledon, Passaic County
Owner: National Aniline Division
Allied Chemical Corporation

Following written request by Mr. William J. Pratt, Plant Engineer, inspection of the subject dam was made on September 2, 1960. Present during the inspection was Mr. August Posch of Mr. Pratt's staff. Upon completion of the inspection, conference thereon was held with Mr. Pratt, Mr. Harold T. Madden, Vice President, and another managerial representative. Conference was limited to generalities because report had to await study and evaluation of photographs and data collected during the inspection.

Dense underbrush and stands of trees on and below the dam largely limited inspection to observation from the dam crest. Hence the survey, the findings of which are outlined below, cannot be considered complete.

Westerly Section of Embankment

(a) Crest width varies from 5 to 10 or more feet.
(b) Entire downstream slope, averaging perhaps 1 on 1½, is covered with dense underbrush and trees up to 12 inches in diameter.
(c) Embankment adjacent to west abutment of west spillway is badly eroded or abraded (see photograph D).
(d) Some seepage, presumably originating from either the rupturing of the concrete face of the dam or the separation thereof from the west abutment of the west spillway, is occurring through the eroded section of the embankment. Seepage is expediently piped. No transportation of fines was observed. Embankment adjacent to pipe was damp but no flow was evident.
(e) Balance of slope was not surveyed because of ground cover which included much poison ivy.

Westerly Spillway

(a) No major deficiencies were observed.
(b) Seepage is occurring from beneath 4-inch concrete cap cast on top of old spillway.
(c) Concrete placed over old, spalled downstream face of spillway is flaking off.
(d) Some seepage is occurring through lateral seams or construction joints in the west abutment. Source of water is probably the same as that noted above.

West Central Section of Embankment

(a) Embankment adjacent to the east abutment of west spillway is eroded or abraded (see photograph B), but no seepage therefrom was evident.
(b) Crest width varies from 15 feet at west spillway abutment to 6-8 feet at west abutment of central spillway.
(c) Entire downstream slope, averaging perhaps 1 on 1½, is covered with trees and dense underbrush (see photograph F).
(d) Toe of slope was unobservable because of ground cover.

Central Spillway

(a) No major structural defects noted.
(b) No seepage from masonry downstream face evident.
(c) No seepage from beneath spillway revealed by observation from crest.
(d) Crest is obstructed by stands of weeds at upstream edge of spillway where it meets pond bottom (see photograph F & F).
(e) A large double tree is located 3 or 4 feet downstream of toe of east abutment, but the effect of its roots on the spillway foundations is unknown.

East Central Section of Embankment

(a) Crest width varies from a minimum of 10 feet.
(b) Entire downstream slope, averaging perhaps 1 on 2, is covered with dense underbrush and with trees, singly and in groups, 12 to 14 inches in diameter. Several large trees are within 10 or 15 feet of the concrete upstream face of the embankment. More than a few are dead or dying.

Easterly Spillway

(a) Spillway apron partially undermined and broken up.

Easterly Section of the Embankment

(a) No deficiencies noted.

During the conference Mr. Pratt inquired about the effect on the dam of noticeable earth tremors caused by blasting at a quarry some two miles away. The writer stated his lack of competence in such matters and recommended that the company arrange for a geological survey by a consulting firm.

In order to forestall future requests from Mr. Pratt's company for free engineering, the writer tried during the conference to make the point that ~~this Division is~~ not authorized to perform ~~such a~~ "personal" services. Hence the referral to a consulting geologist.
State agencies are

James C. Riley
Principal Engineer, Hydraulic

Trenton, New Jersey
October 21, 1960

OLDHAM POND DAM
DAM APPLICATION NO. 400-A

This report is to describe the improvements made during May and June, 1962, at the Oldham Pond Dam to increase the stability of the structures as requested in the letter of October 31, 1960 from the Department of Conservation and Economic Development to Harmon Colors, National Aniline Division of Allied Chemical Corporation.

West Spillway - West Abutment

The first fill placed upstream of this abutment was by clamshell lowered through the water to the lake bottom and then opened. Every effort was made to get the earth under the foundation of the longitudinal wall. Two men using wood poles rammed the earth into the space. This was continued until the earth fill was well above the top of the foundation when a very large quantity of fill was placed to make an earth blanket up to 5 to 6 feet deep in front of the abutment and longitudinal wall.

This did not stop the small seepage, but later on dropping the lake about 5 inches, it was noticed seepage did cease. Additional fill was placed along the side of the abutment which has apparently stopped all seepage with water passing over the spillway.

It thus appears that seepage was not passing under the foundation

of the longitudinal wall as originally believed, but through the masonry abutment wall a few inches below spillway level. The extent and depth of fill as placed is indicated on the as built drawing.

In making excavations in the earth fill adjacent to the abutment, it was found that the longitudinal wall was much thicker than had been anticipated and a cutoff wall existed that extended into the fill about four feet. The location of this wall is indicated.

A rock toe was constructed in the eroded section adjacent to the abutment by starting about 11 feet downstream from the end of the abutment wall and carried up the slope as shown on the drawing. A bank run sand and gravel was laid adjacent to the earth fill over which a heavier stone was placed to make an effective filter to dissipate any seepage should it occur and to prevent erosion in back of the wall.

The upstream impervious fill section was then placed from the rock toe to the upstream wall with the top of the fill slightly above the top of the abutment wall and graded toward the upstream side for drainage to pass to the lake.

West Spillway - East Abutment

Seepage conditions were investigated at the east abutment by releasing fluorescein at the lake bottom about 6 feet upstream from the wall to determine where the seepage might be leaving the lake. As a result of this test

an extensive earth blanket about 4 to 5 feet thick requiring hundreds of yards of fill was placed over the lake bottom and resulted in complete stoppage of the seepage that had been emerging for years at the downstream end of the abutment wall.

Two heavy rock toes with sand and gravel filter were also placed downstream of the downstream longitudinal wall to dissipate any energy from seepage that might occur in the future.

The eroded gully adjacent to the abutment wall was brought up to the earth dam level by placing rock on the slope at the downstream section of the gully and good fill in the impervious zone.

A substantial quantity of excess material was stored on the top of the earth dam for use in maintaining the earth surface should it become necessary before the new fill becomes stabilized.

Trees

All the trees on the earth dam and within 20 feet downstream of the downstream toe of the slope have been cut down to within 6 inches of the ground.

The surface of the slope is covered with poison ivy and a heavy undergrowth which makes a heavy cover at this time.

In the fall it is proposed to go over the slopes, remove any undesirable brush and if existing vines are not sufficient to prevent erosion,

measures will be initiated to protect the downstream slope from erosion.

The weeds at the upstream edge of the center spillway have been removed to increase the spillway discharge capacity.

East Spillway

Drawing H-2 has been revised to show the as built conditions of the east spillway. The construction was substantially the same as originally submitted. It was possible to undercut the abutment walls slightly. The reinforced concrete slab was constructed with new walls extending down as indicated along both existing abutment walls and across the breast of the dam just downstream from the existing masonry section at the upstream weir.

The slab itself was poured in two sections. The fill under the longitudinal joint was protected from the erosion by a concrete lip extending down under the upstream concrete slab. The drainage provisions are shown.

An additional reinforced concrete slab was placed downstream of the main slab and bonded into the existing slab.

The broken up concrete from the old slab was placed in the channel downstream of the paved area.

Earth Embankment at the West End

The area between the west spillway and the west end of the earth dam was used for dumping and storing considerable earth fill which was

later used on the dam. A ramp down from top of dam was made to transport the earth fill to the stilling basin area where it was lifted by crane for placing on the east side of the spillway. Much of this hauled fill still remains and has resulted in a very substantial increase in the earth dam section at the west end. The top width of the embankment varies from 22 feet wide at the abutment to 31 feet wide at a distance of 50 feet from the west abutment which width is maintained to the right end. The earth is graded to drain to the lake.

Photographs

In accordance with the request of the representatives of the Department of Conservation and Economic Development, photographs were taken during the period of reconstruction and are enclosed.

As Built Drawings

Drawings H-1 and H-2 have been revised to show the repairs as made at the East and West spillways with important elevations of the structures.

Certification

This is to certify that modifications to the existing structures have been made in accordance with the as built drawings as submitted with this report.

N. C. Courtney, License No. N. J. 3504

July 26, 1962

4

MEMORANDUM

DATE September 17, 1963

TO: Robert L. Hardman

FROM: Raymond A. Webster

SUBJECT: Dam Inspection: Harmon Color Works, Oldham Pond
Dam Application No. 400-B

Inspection was made of the foundation prepared for the apron and new face of the west spillway for subject dam on September 10, 1963.

Mr. N. C. Courtney, Consulting Engineer for the applicant was present.

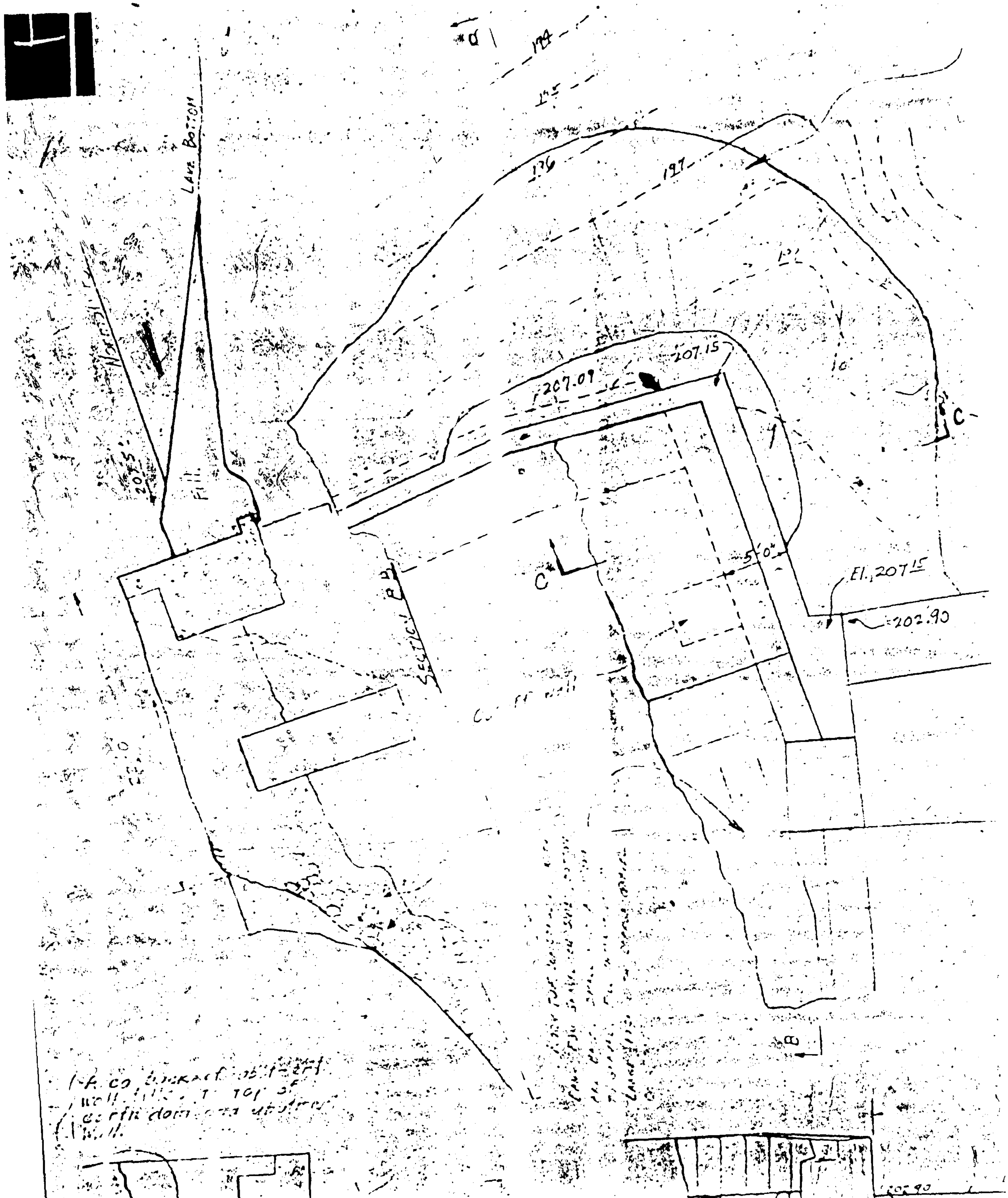
The foundation is being prepared in three sections: west, center, and east. Mr. Courtney gave me photographs of the west section, exposed September 4, 1963. These and photos taken on September 10th attached hereto.

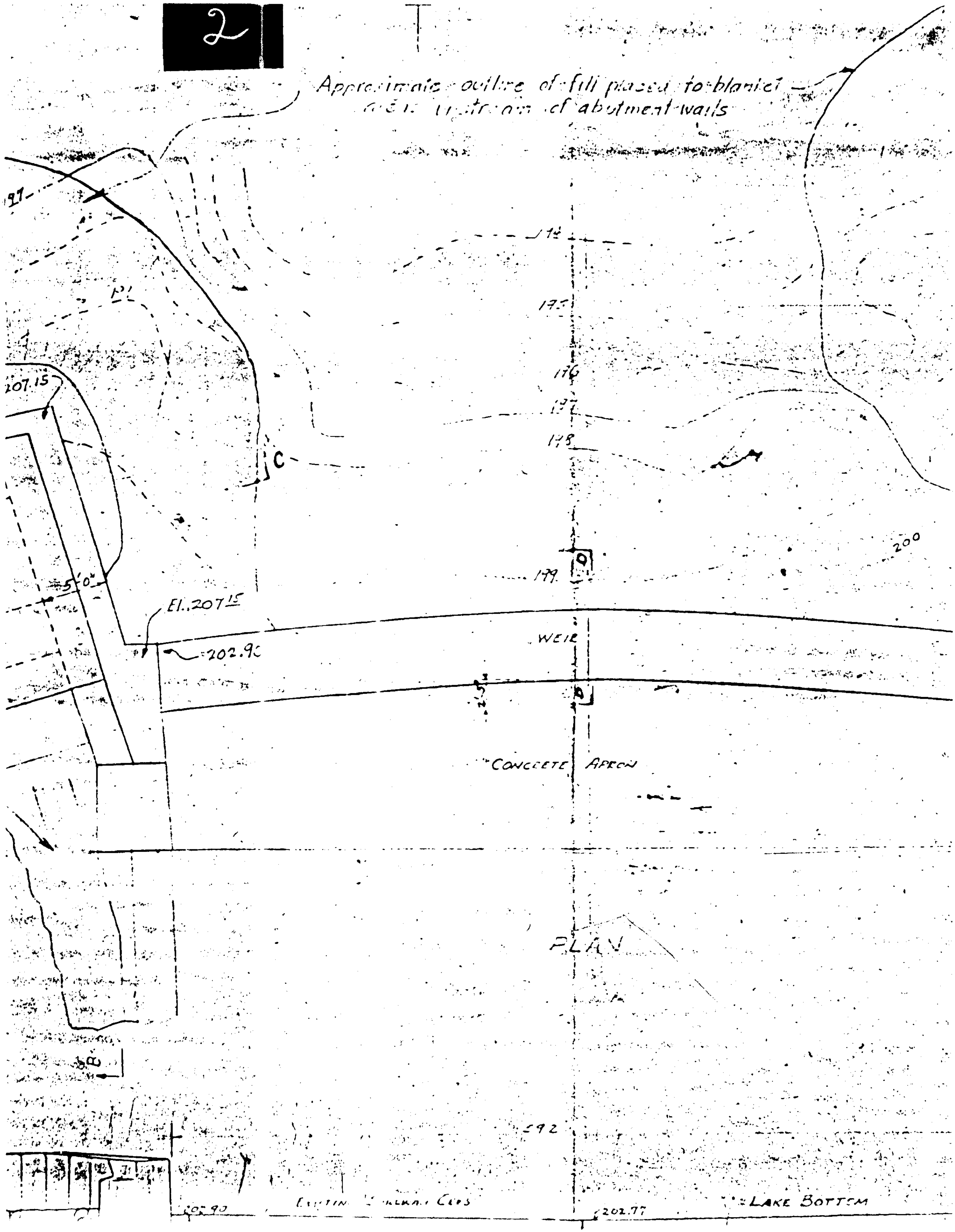
East section was excavated to rock and hard pan, which is satisfactory material for this foundation. I gave verbal approval to proceed.

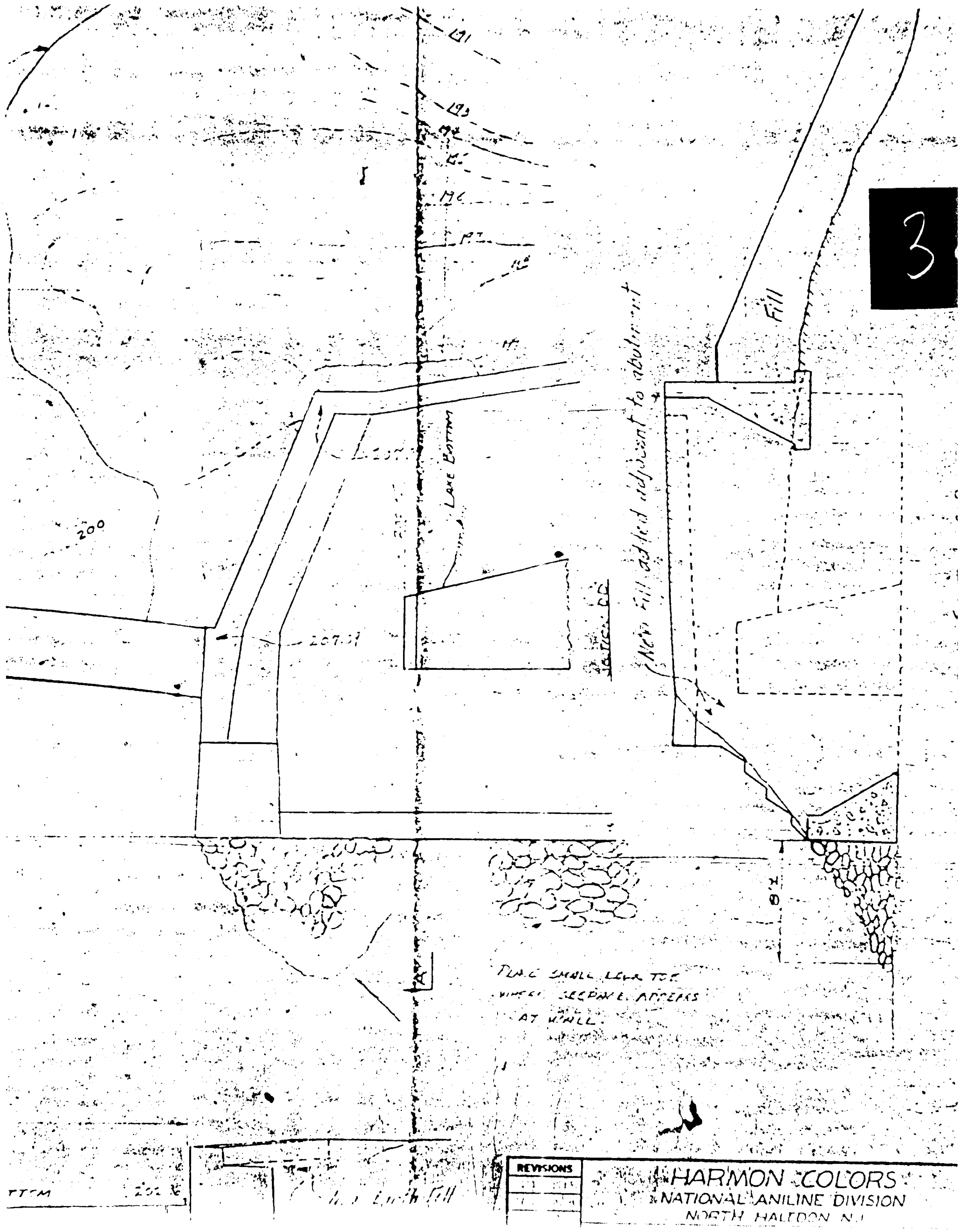
RAW:am

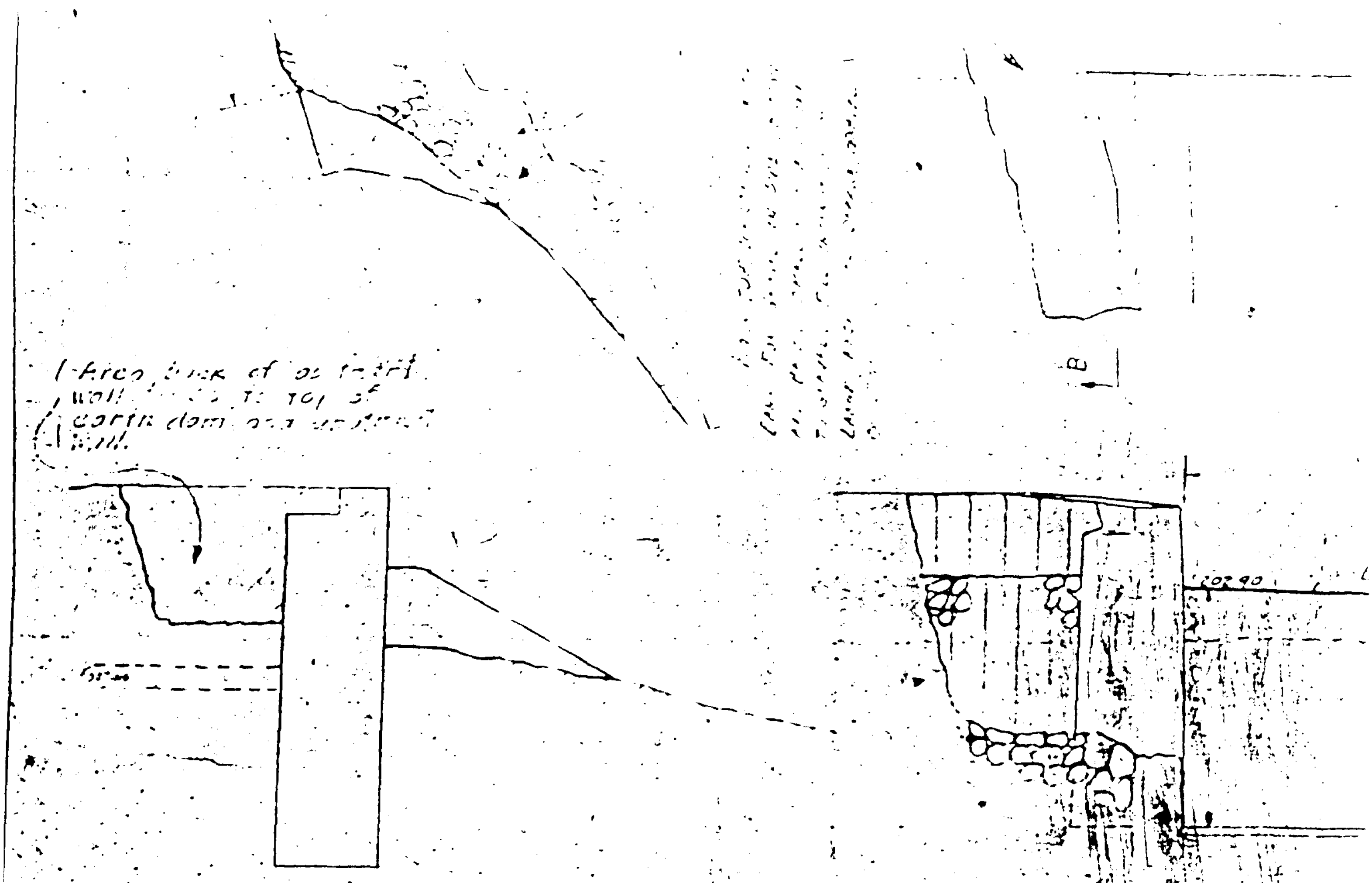
Encs.

Raymond A. Webster


LAKE BOTTOM
Fill
207.09
207.15
C
5'0"
El. 207.15
202.90

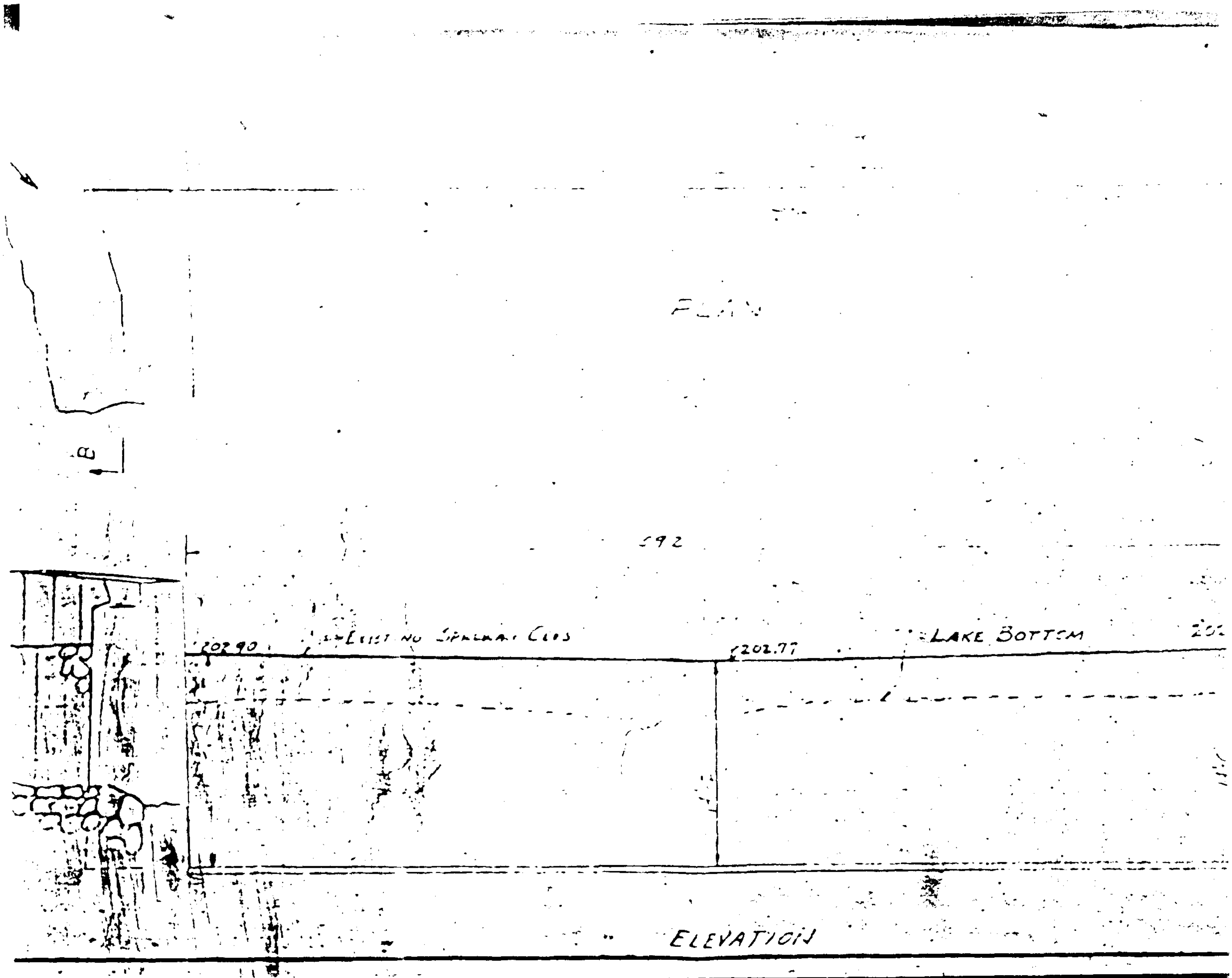

2
Approximate outline of fill placed to blanket
area upstream of abutment walls
197
174
175
176
177
178
C
200
D
179
El. 207 15
207.15
5'0"
202.90
WEIR
D
CONCRETE APRON
PLAN
B
592
LAKE BOTTOM
202.77


3
Fill
New fill added adjacent to abutment
Lake Bottom
Section CC
200
207.31
Place small rock toe where seepage appears at wall.
8'
REVISIONS
HARMON COLORS
NATIONAL ANILINE DIVISION
NORTH HALEDON N.J.

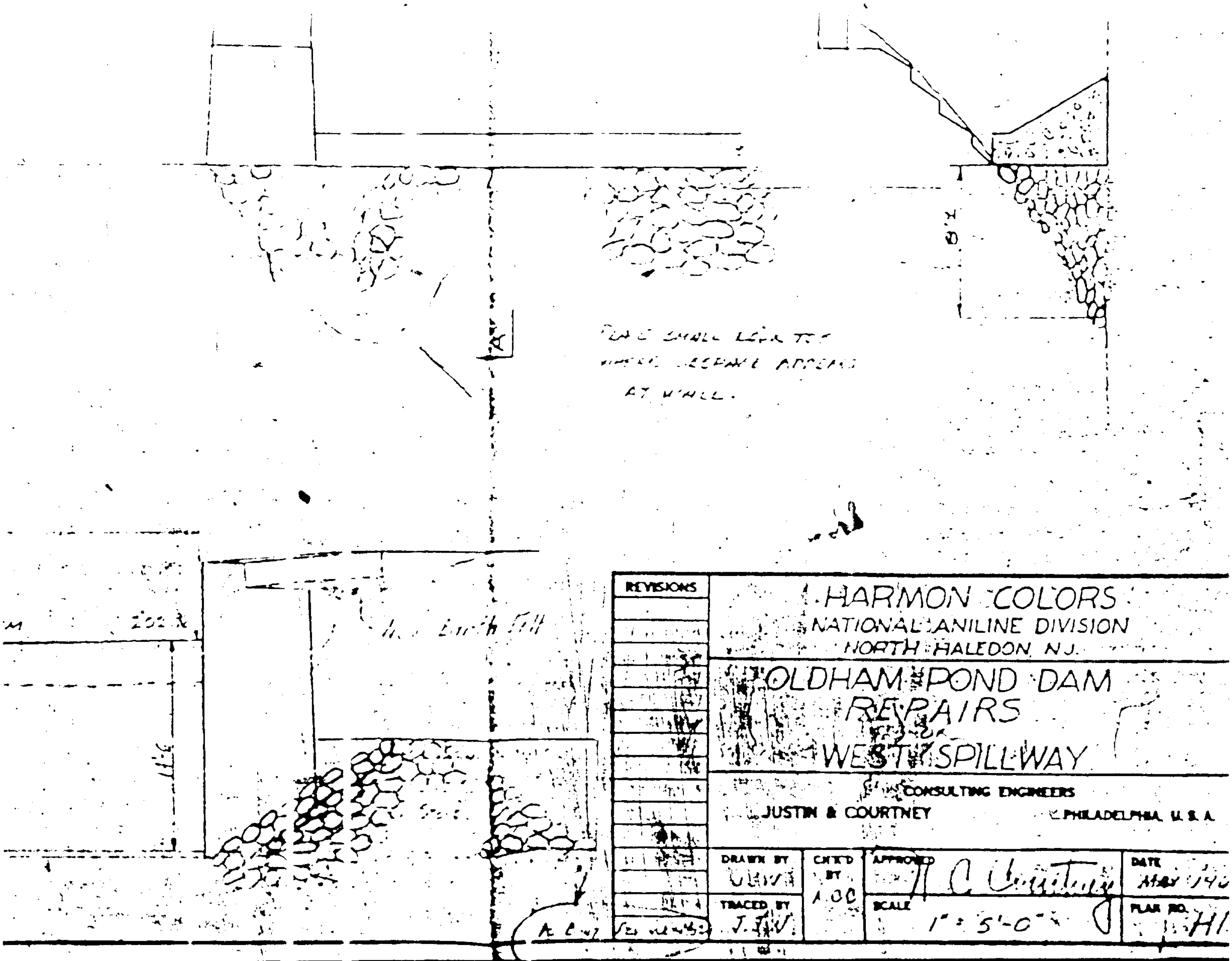


SECTION CC

4



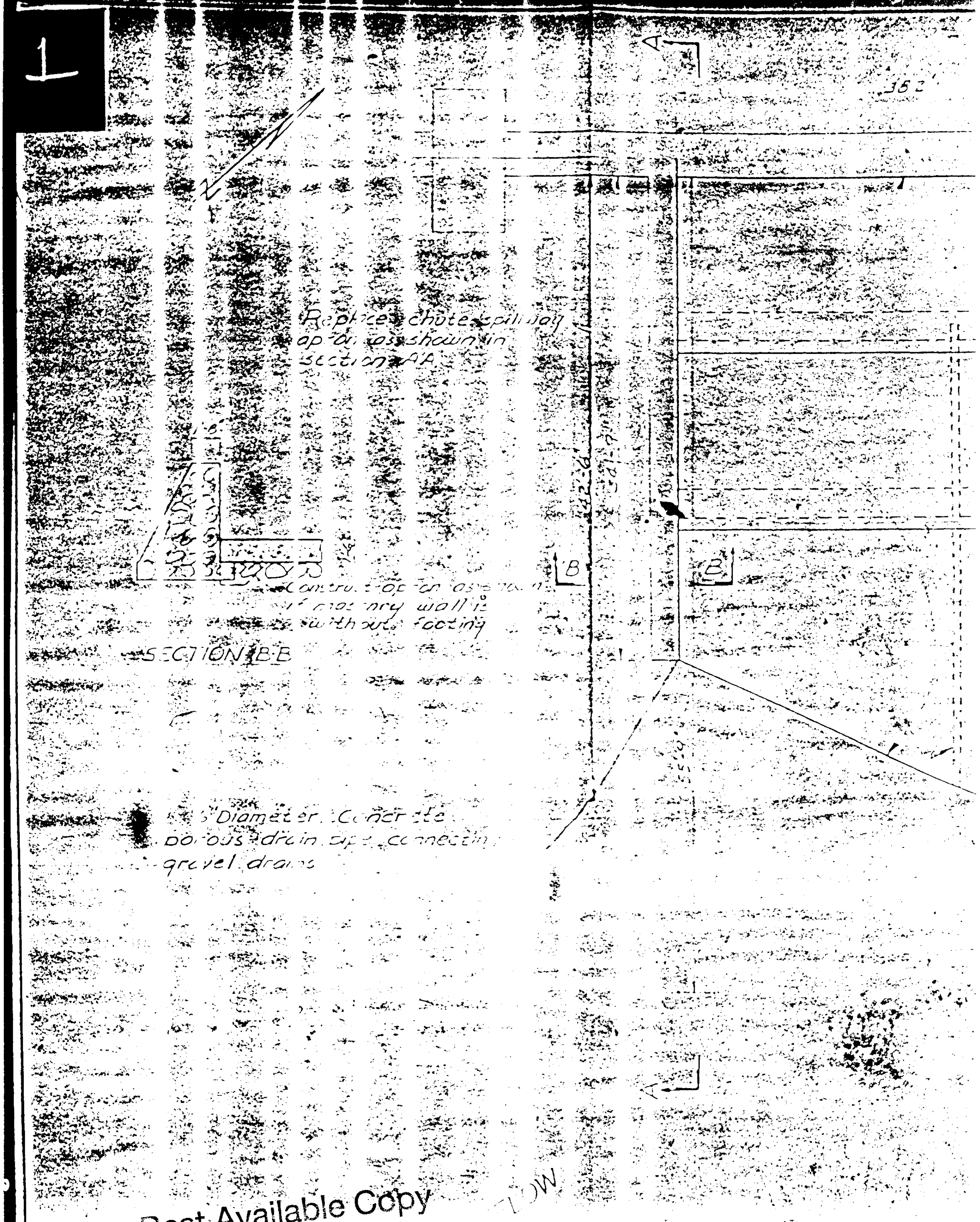
5

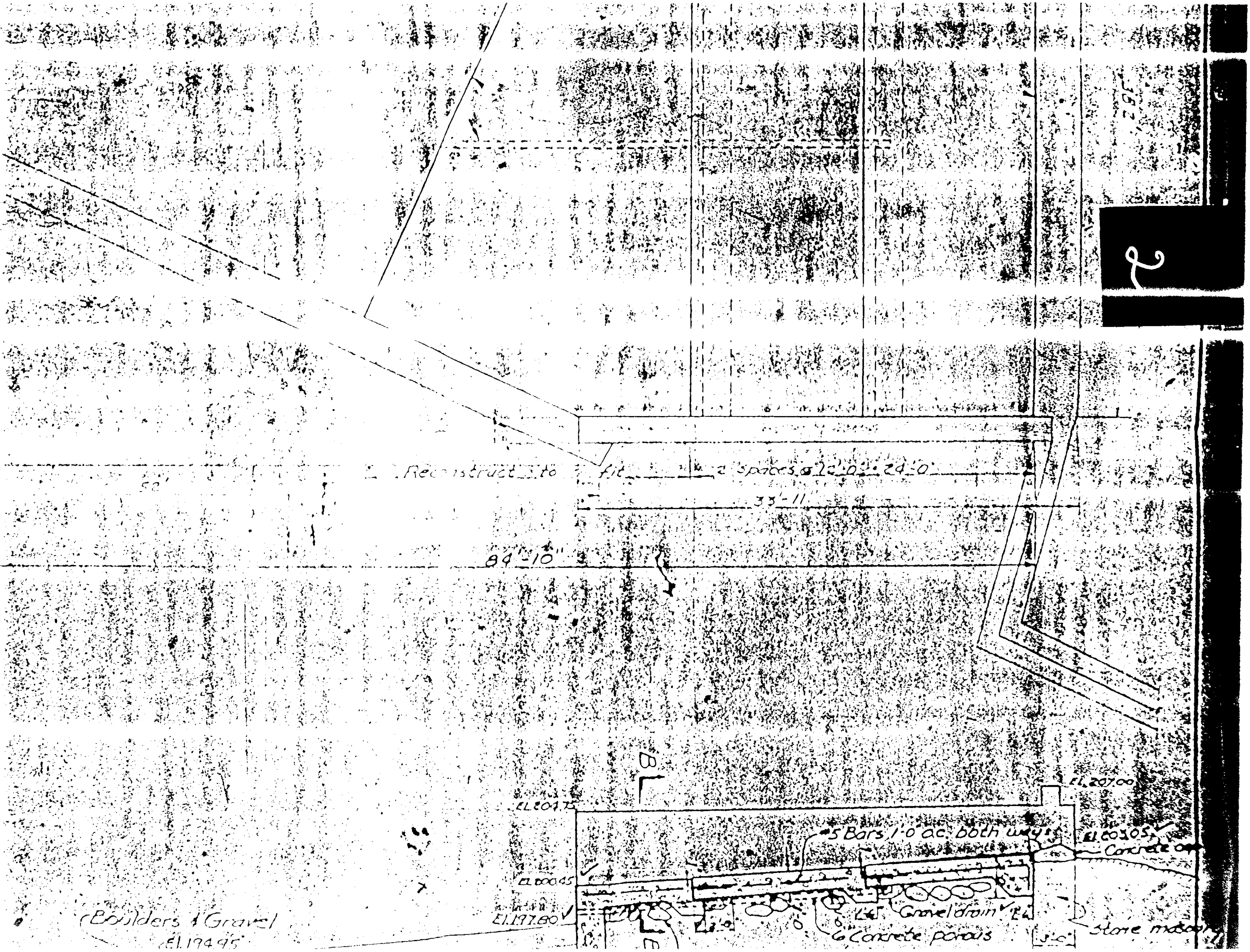


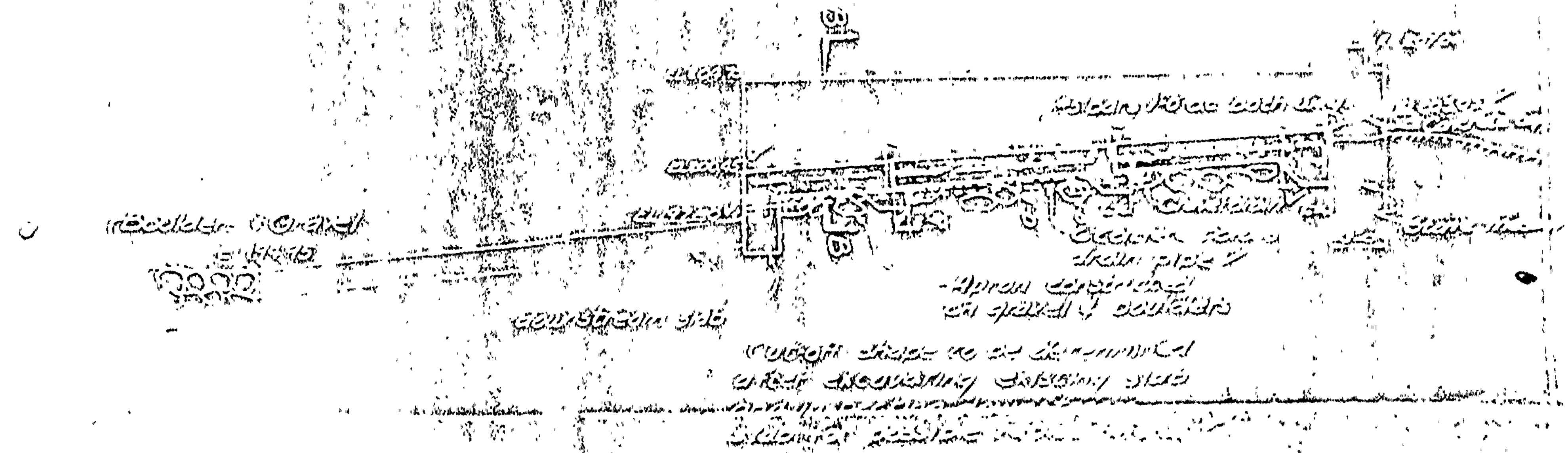
REVISIONS
HARMON COLORS
NATIONAL ANILINE DIVISION
NORTH HALEDON, N.J.
OLDHAM POND DAM
REPAIRS
WEST SPILLWAY
CONSULTING ENGINEERS
JUSTIN & COURTNEY
PHILADELPHIA, U.S.A.
DRAWN BY
CHK'D BY
APPROVED
DATE
TRACED BY
SCALE
1" = 5'-0"
PLAN NO.

6

1


A
352
Replace chute spillway
apron as shown in
section AA
B
Construct apron as shown
if masonry wall is
without footing
SECTION B-B
Diameter Concrete
porous drain pipe connectin
gravel drains
A

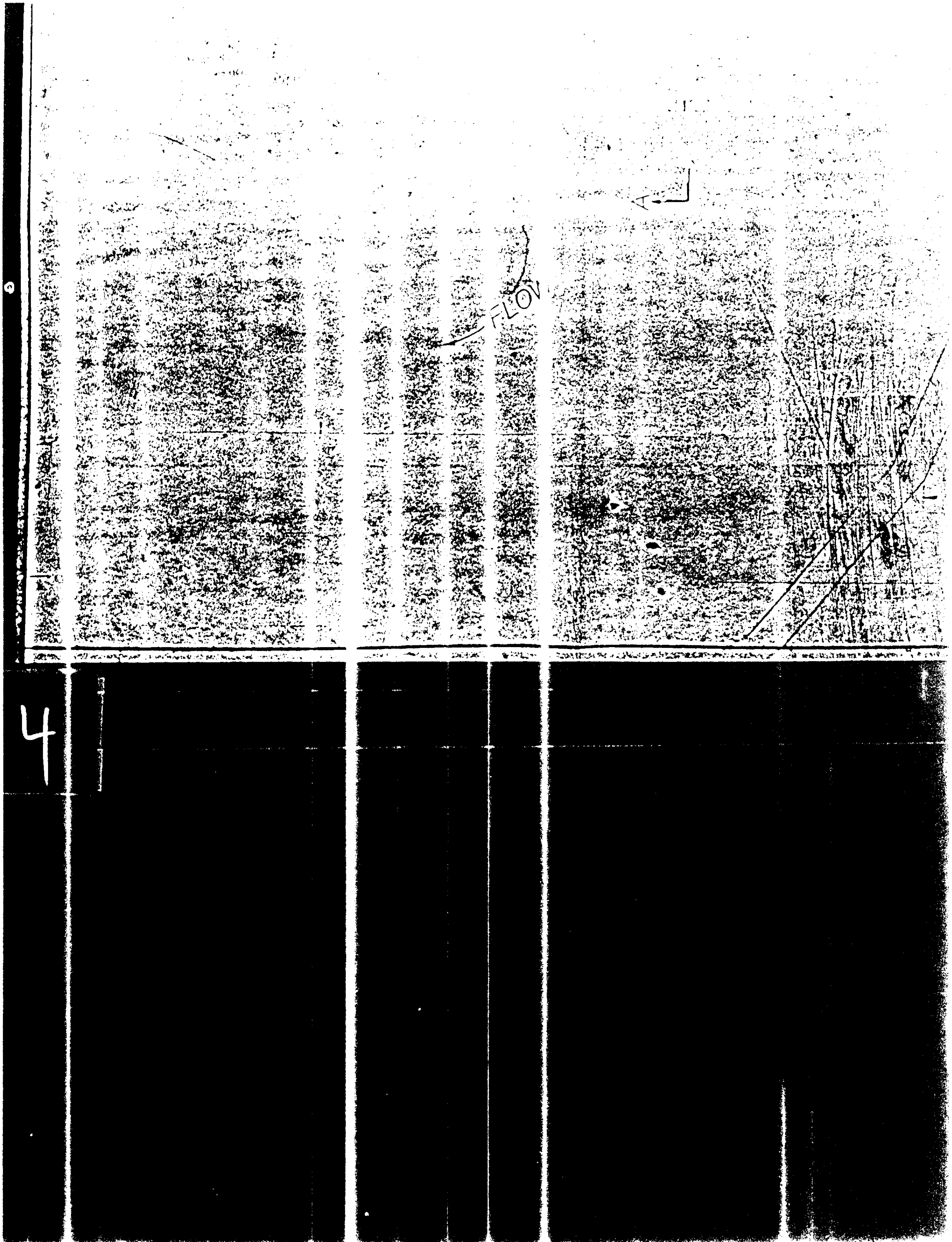

2
382
Reconstruct to fit
2 Spaces @ 12'-0" = 24'-0"
33'-11"
84'-10"
B
EL.207.00
EL.203.05
Concrete
EL.201.75
#5 Bars 1'-0" o.c. both ways
EL.200.45
EL.197.80
Gravel drain
6" Concrete porous
Stone masonry
(Boulders & Gravel
El.194.95

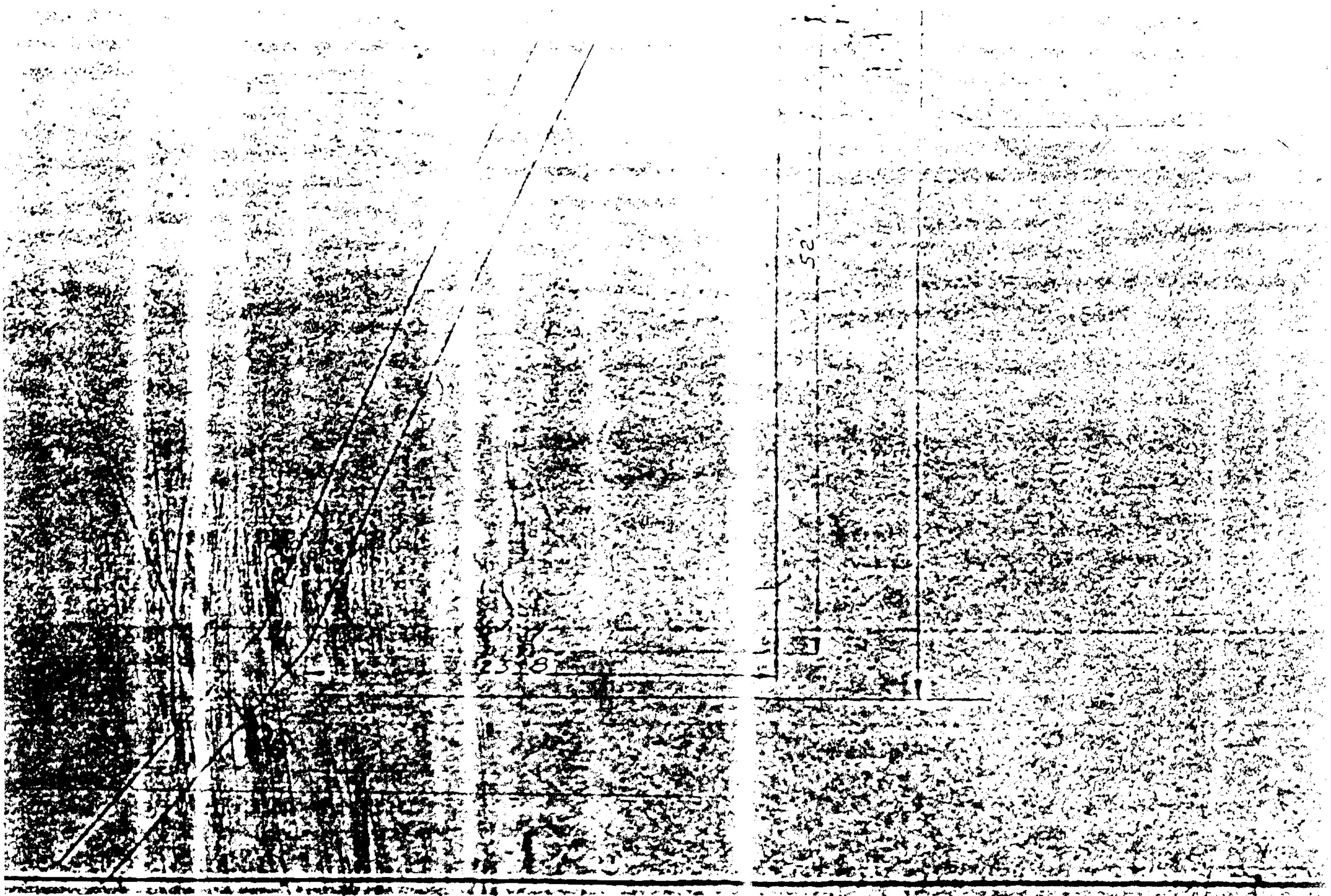


Cutoff shape to be determined after excavating spillway site
Apron constructed on gravel & boulders
downstream side

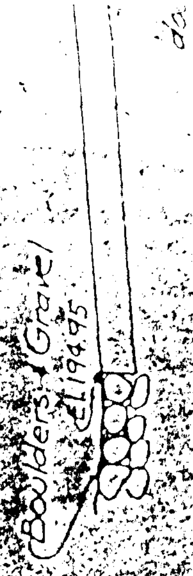
SECTION A-A

3


A
FLOW
4

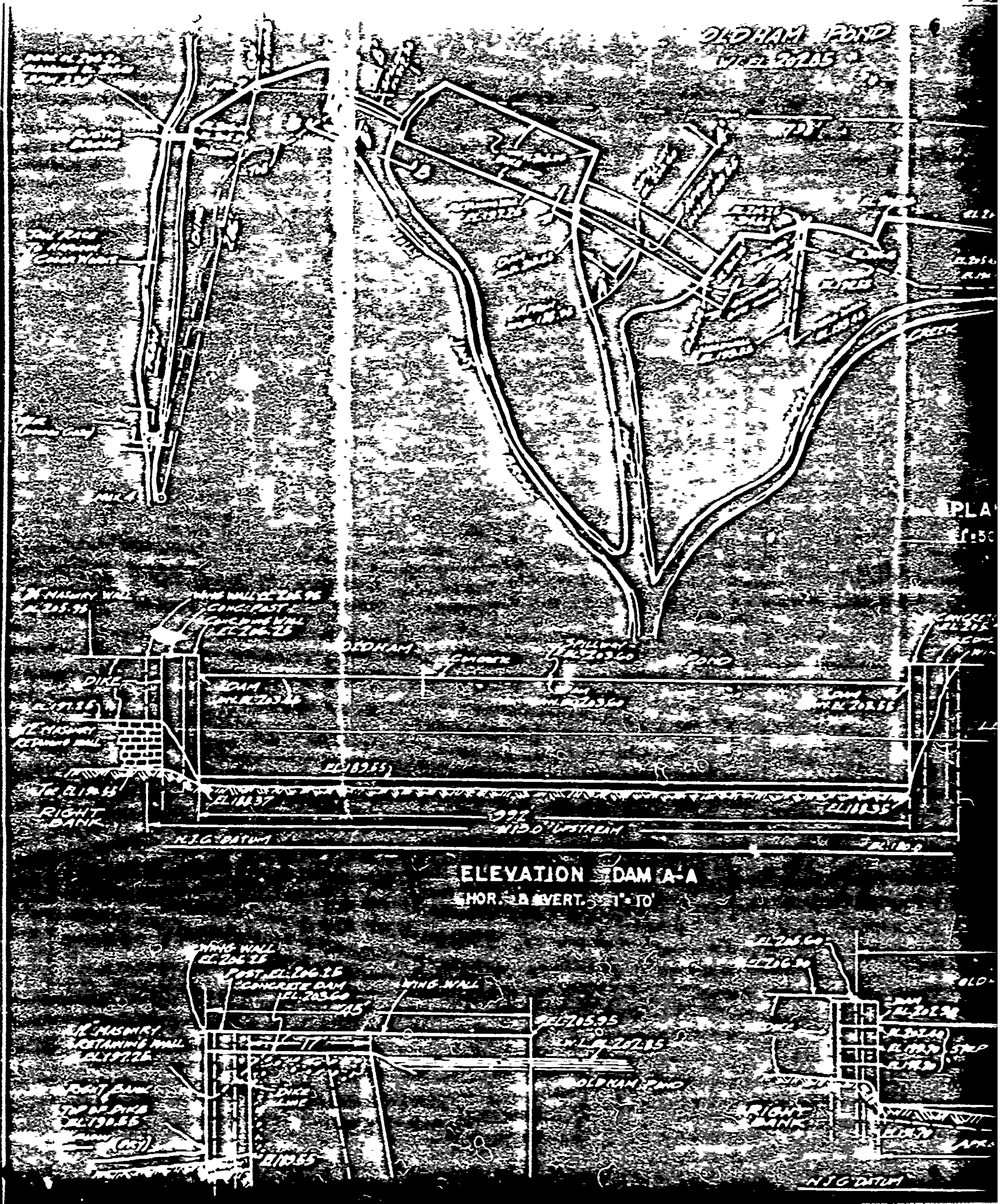


5

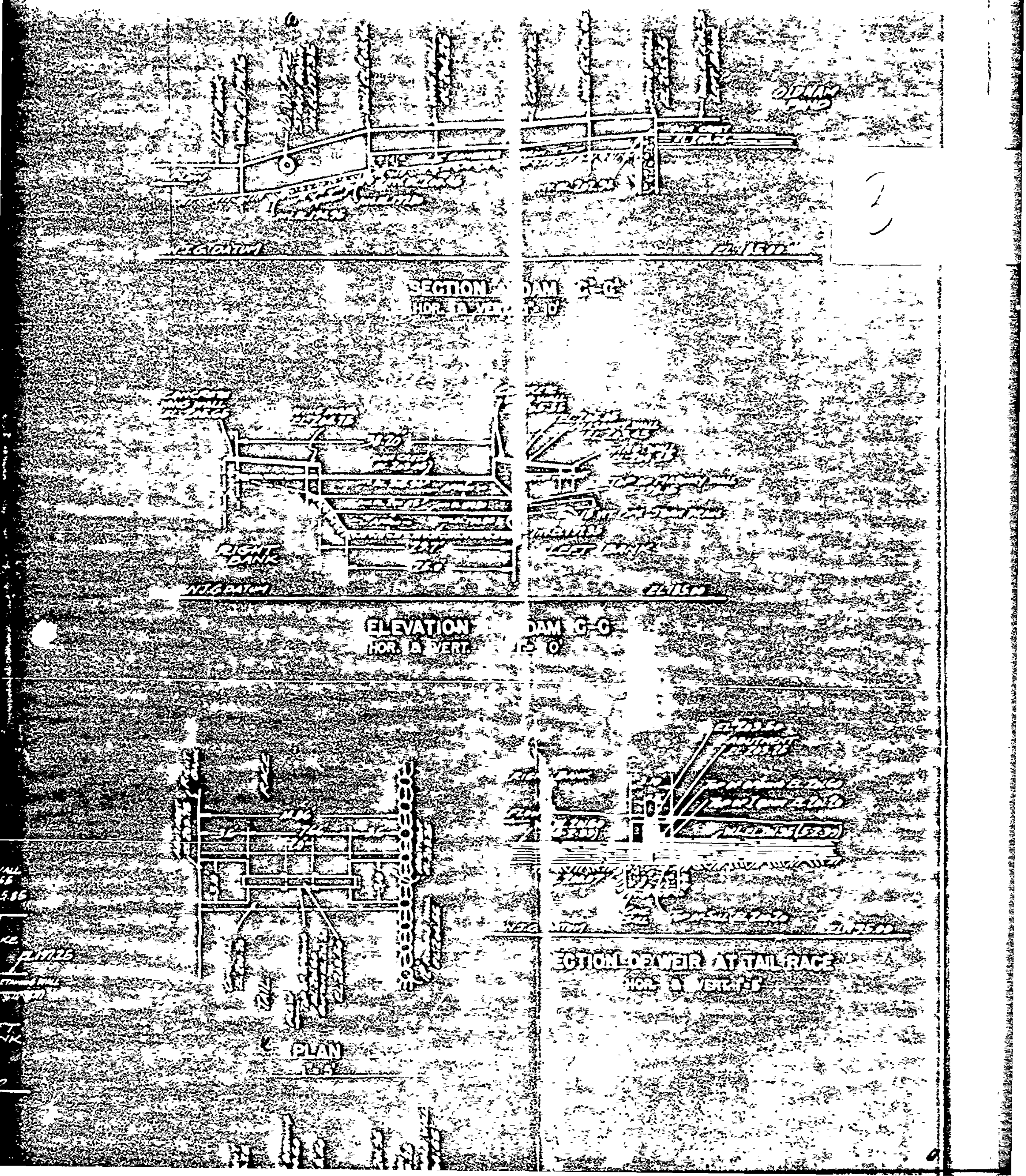


REVISIONS	HARMON COLORS NATIONAL ANILINE DIVISION NORTH HALEDON, N.J.			
	OLDHAM POND DAM PROPOSED REPAIRS OF EAST SPILLWAY			
	CONSULTING ENGINEERS JUSTIN & COURTNEY PHILADELPHIA, U.S.A.			
	DRAWN BY J.J.W.	CH'K'D BY	APPROVED	DATE MAY 1961
	TRACED BY		SCALE 1"=50'	PLAN NO. H2

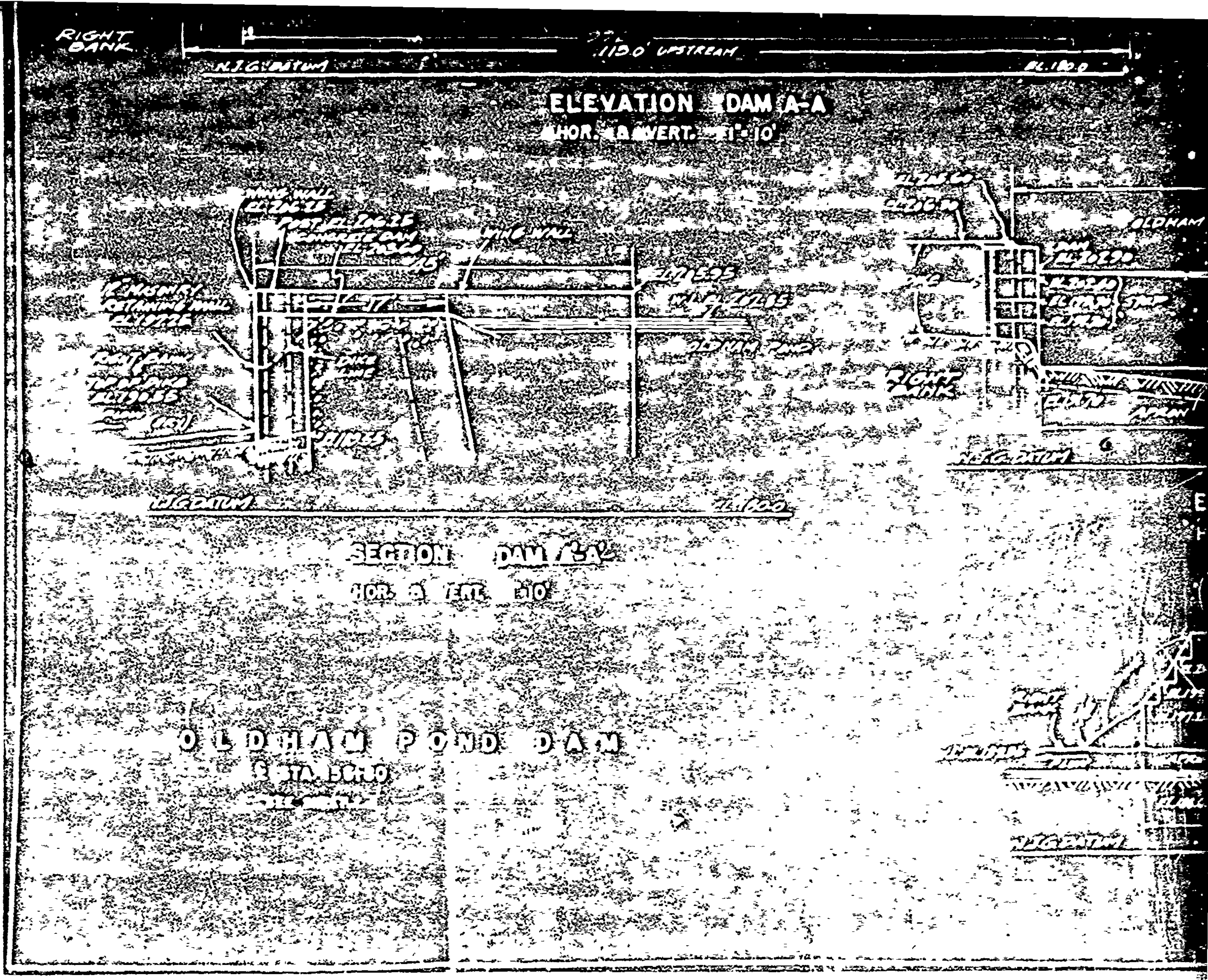
6


OLDHAM POND
W.L. EL. 202.85
SPILLWAY EL. 203.60
OLDHAM
POND
DIKE
RIGHT BANK
N.J.G. DATUM
ELEVATION DAM A-A
HOR. & VERT. 1" = 10'
WING WALL EL. 206.25
CONCRETE DAM EL. 203.60
WING WALL
EL. 205.95
W.L. EL. 202.85
OLDHAM POND
RIGHT BANK
N.J.G. DATUM


OLDHAM POND
2
PLAN
RIGHT BANK
LEFT BANK
A-A
RIGHT BANK
ELEVATION DAM B-B

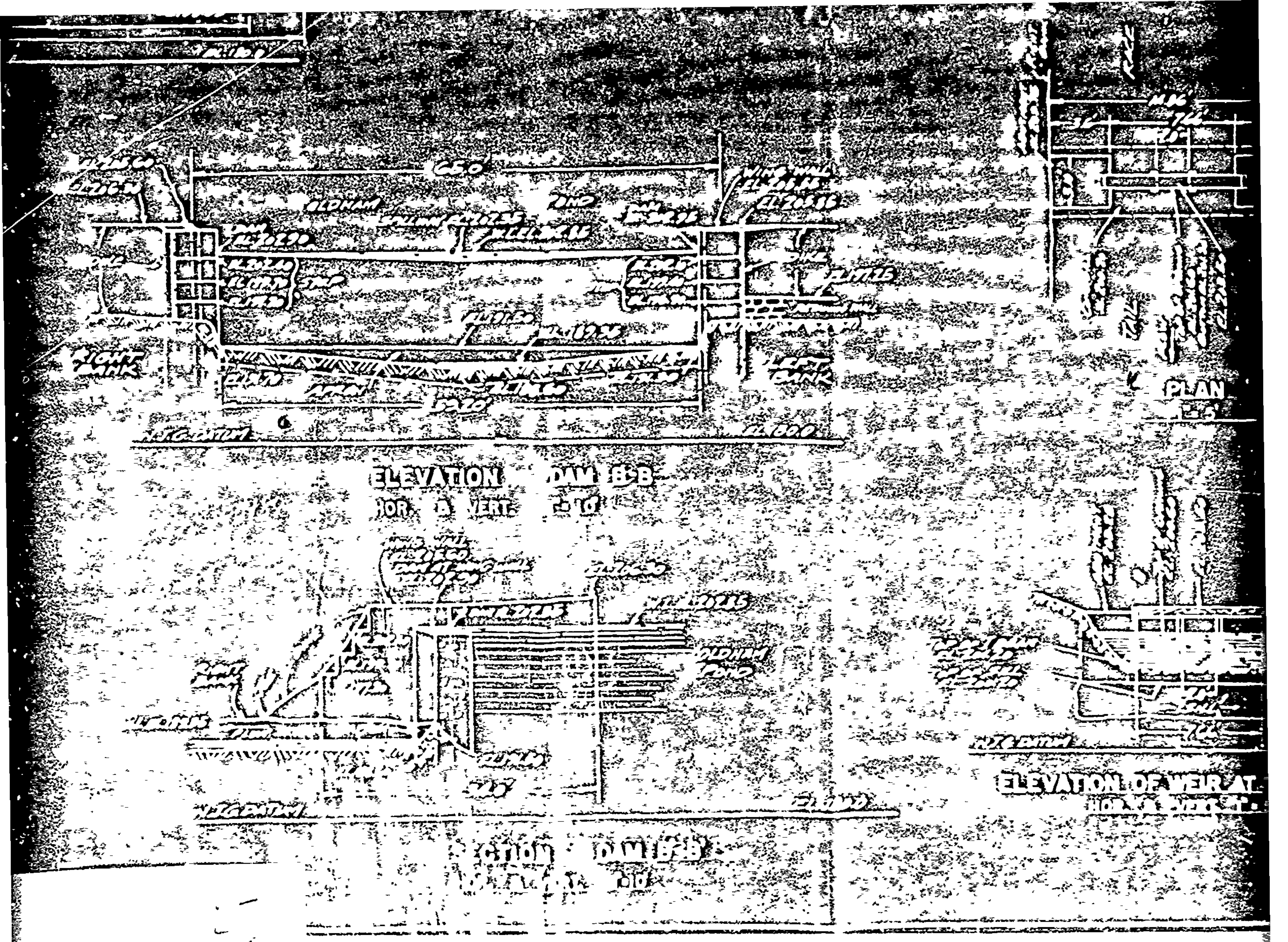


OLD DAM
N.T.G. DATUM
SECTION DAM C-C
ELEVATION DAM C-C
RIGHT BANK
LEFT BANK
SECTION OF WEIR AT TAIL RACE
PLAN

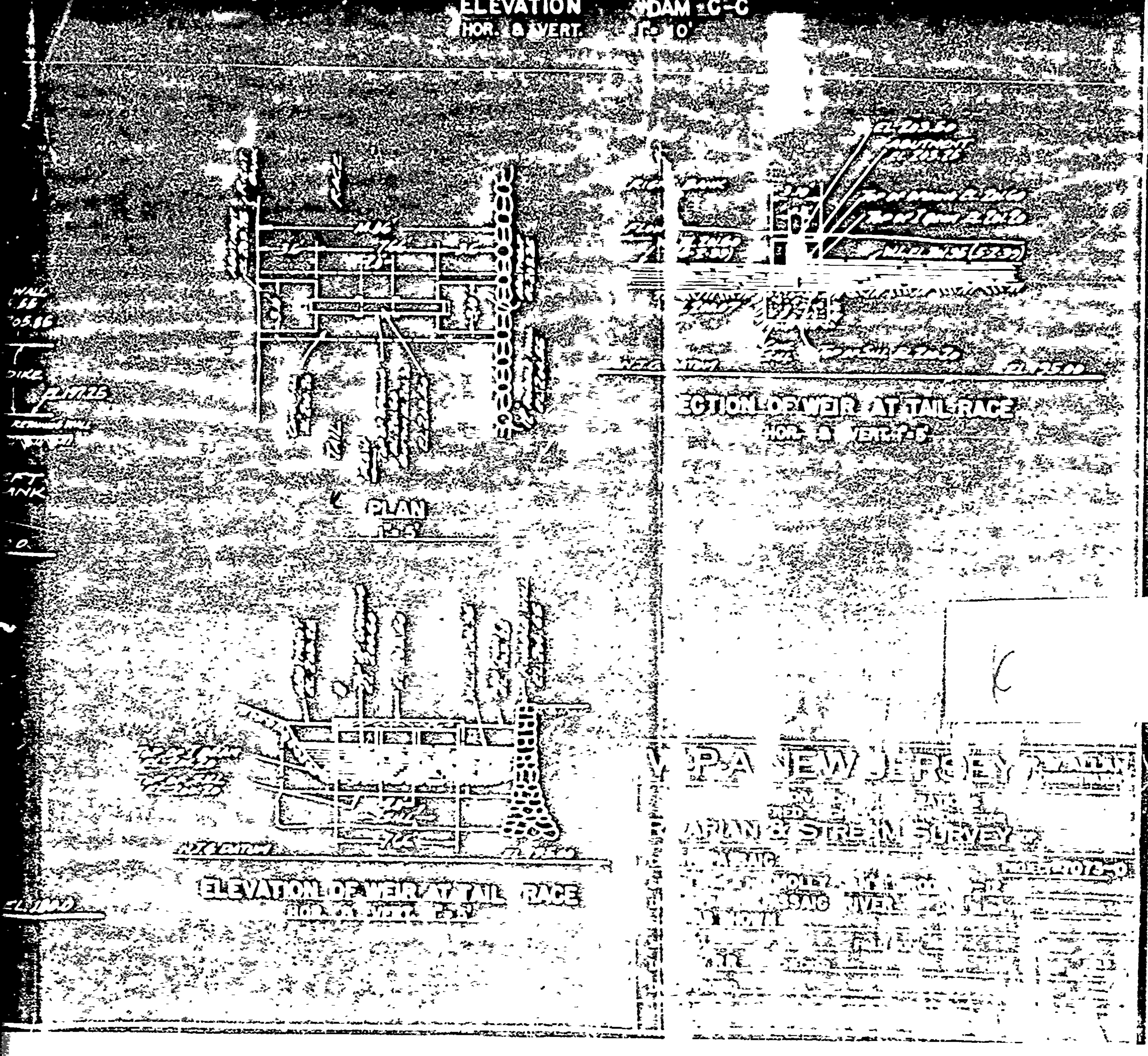


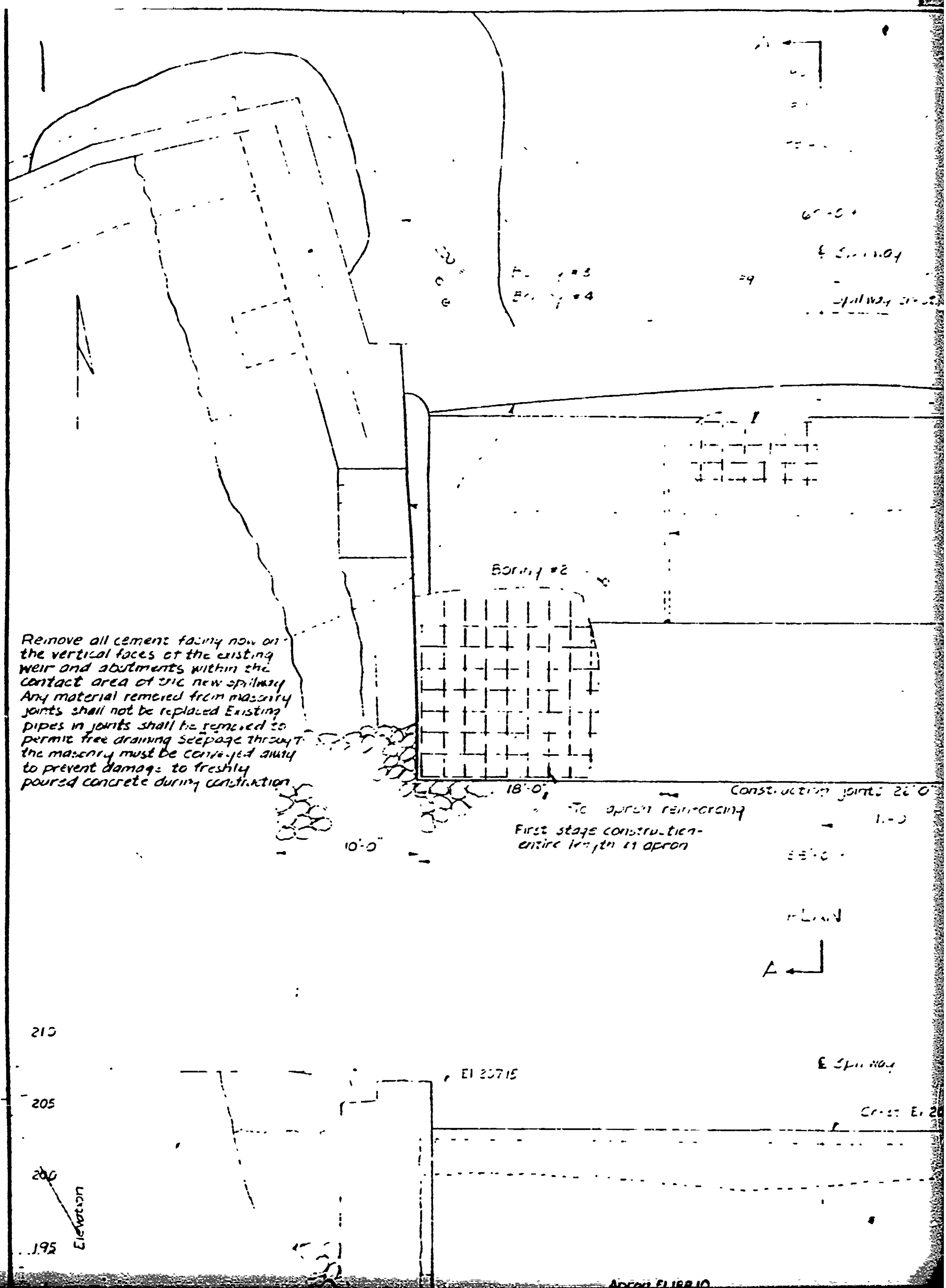
RIGHT BANK
110.0' UPSTREAM
N.J.G. DATUM
ELEVATION DAM A-A
WING WALL
OLDHAM
OLDHAM POND
RIGHT BANK
N.J.G. DATUM
SECTION DAM A-A
OLDHAM POND DAM

4

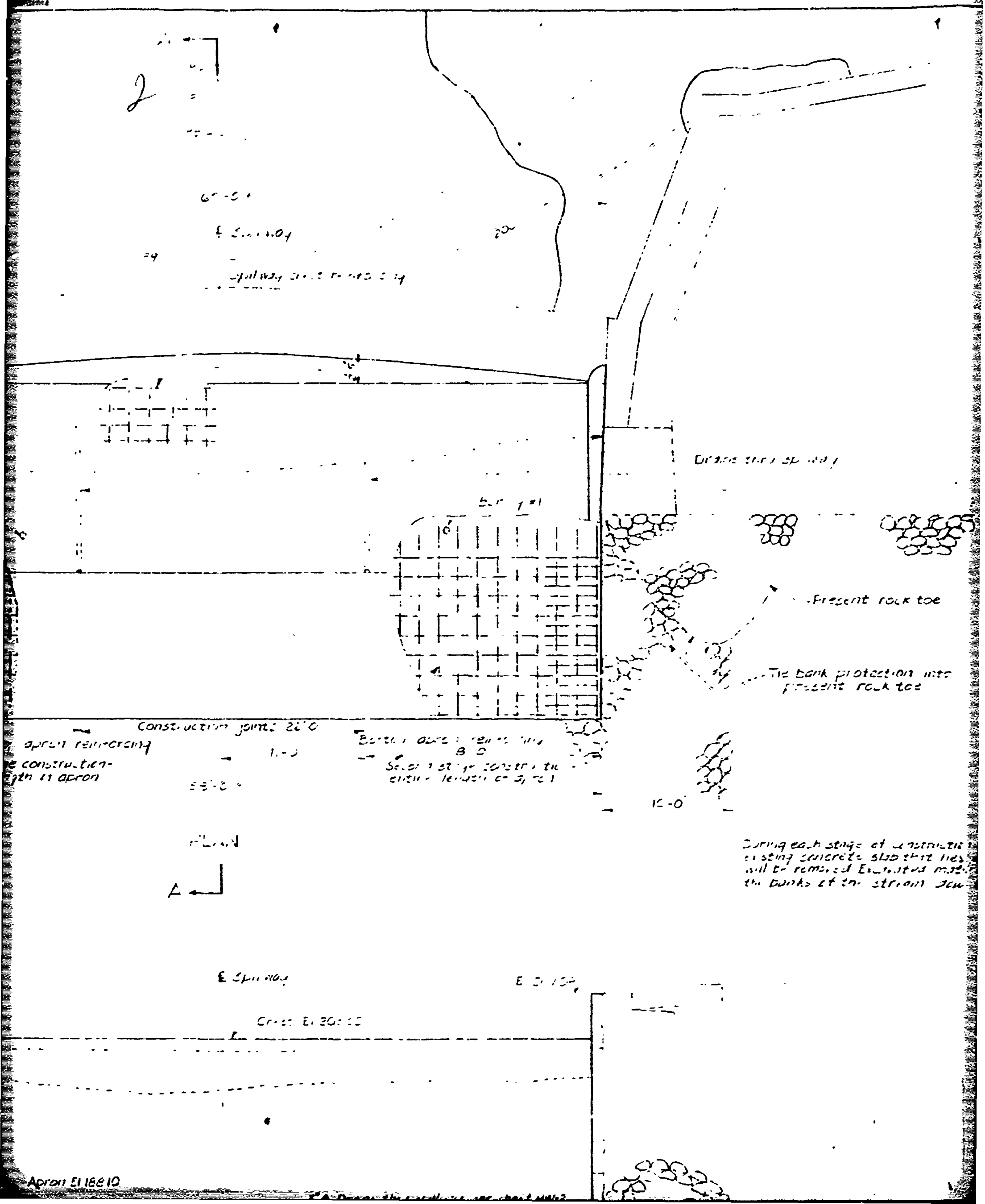


ELEVATION DAM B-B
PLAN
OLDHAM POND
LEFT BANK
ELEVATION OF WEIR AT


ELEVATION DAM C-C
HOR. & VERT.
PLAN
ECTION OF WEIR AT TAIL RACE
HOR. & VERT.
ELEVATION OF WEIR AT TAIL RACE
NEW JERSEY
STREAM SURVEY

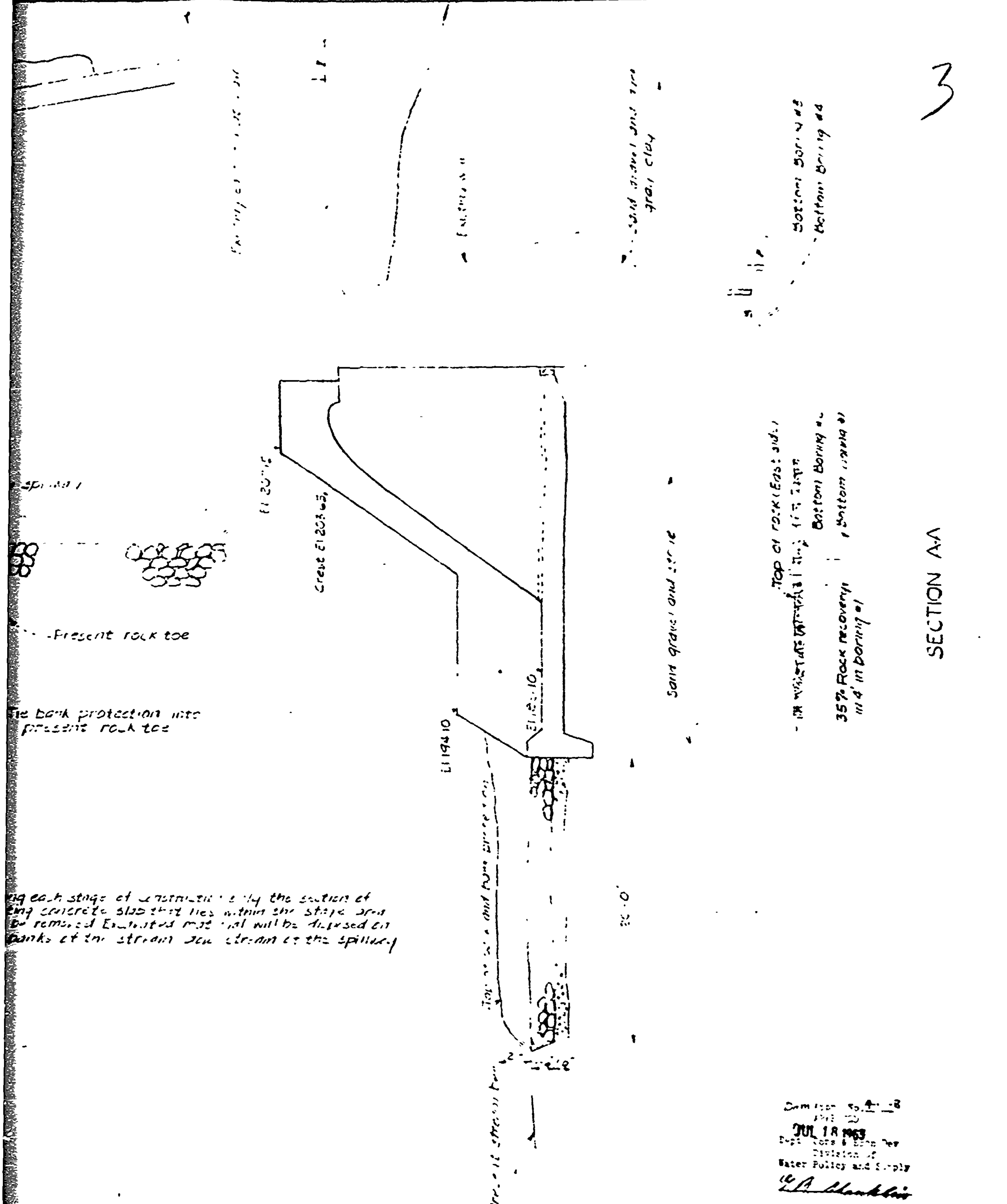


Boring #2
Remove all cement facing now on the vertical faces of the existing weir and abutments within the contact area of the new spillway Any material removed from masonry joints shall not be replaced Existing pipes in joints shall be removed to permit free draining Seepage through the masonry must be conveyed away to prevent damage to freshly poured concrete during construction
18'-0"
10'-0"
First stage construction-entire length of apron
PLAN
EL 207.15
205
Elevation
195



2
Drains thru spillway
Present rock toe
Tie bank protection into present rock toe
Construction joints 22'0
apron reinforcing
construction
length of apron
PLAN
A
℄ Spillway
Apron El 188.10

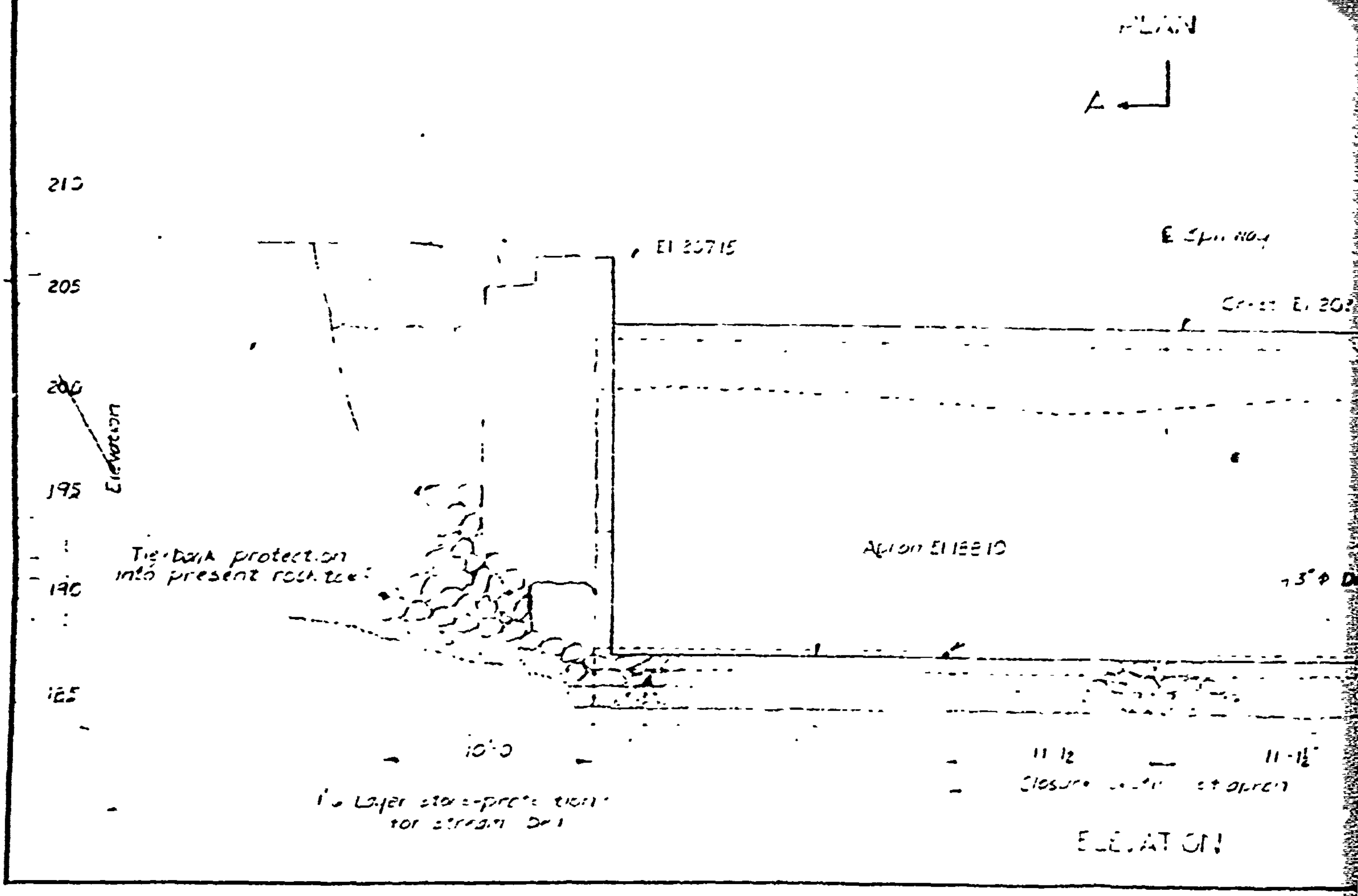
3



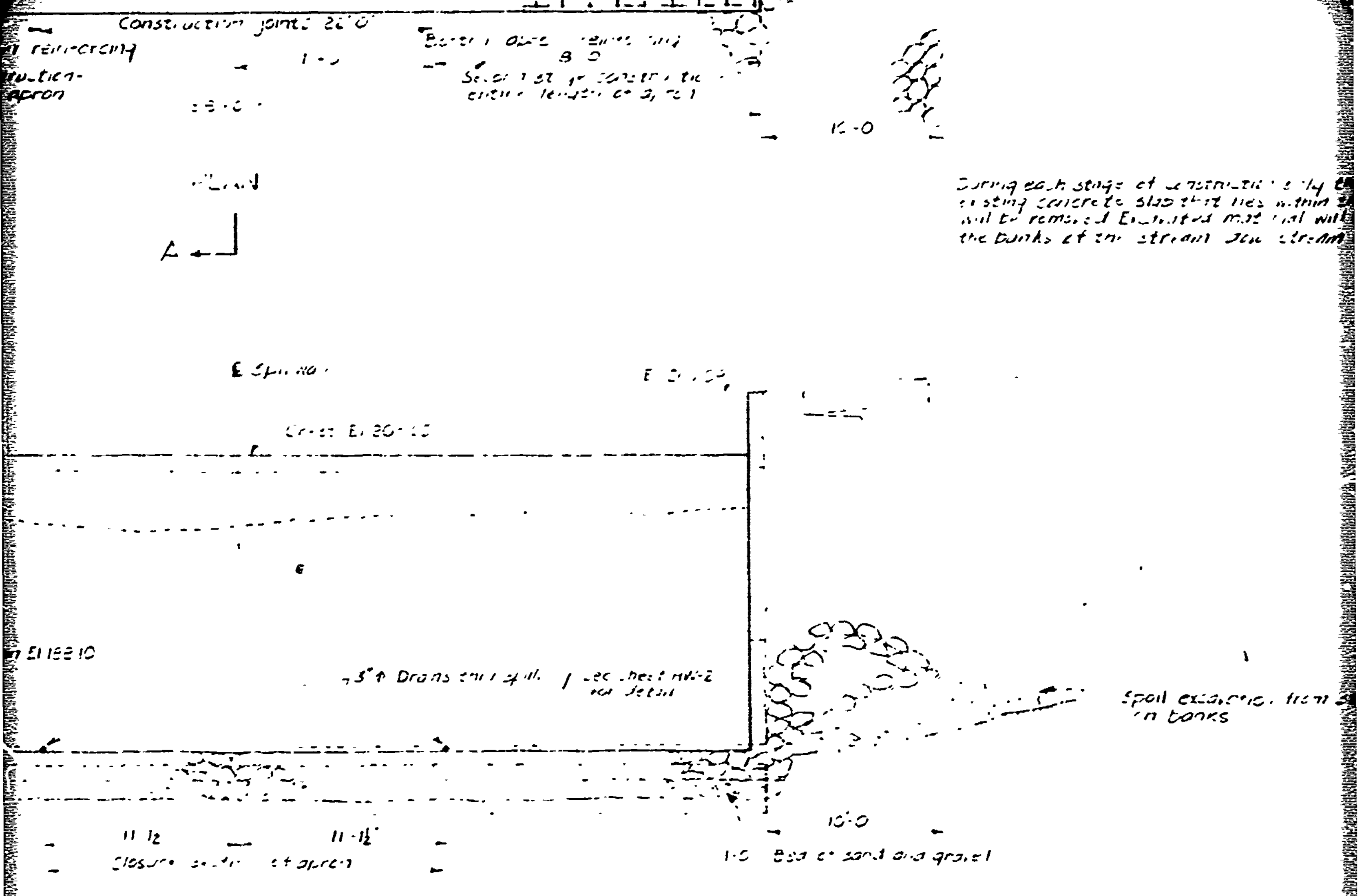
Dam Appl. No. 4-8
JUL 18 1963
Dept. Cons & Econ Dev
Division of
Water Policy and Supply

REVISIONS

HARMON COLORS
NATIONAL ANILINE DIVISION
NORTH HALEDON, N.J.


PLAN
A
210
205
200
195
190
185
Elevation
El 207.15
℄ Spillway
Crest El 20
Tie-bank protection
into present rock toe
Apron El 188.10
3" ϕ
10'-0
1½ Layer stone protection
for stream bed
11 ½
11-1½"
Closure
ELEVATION

4



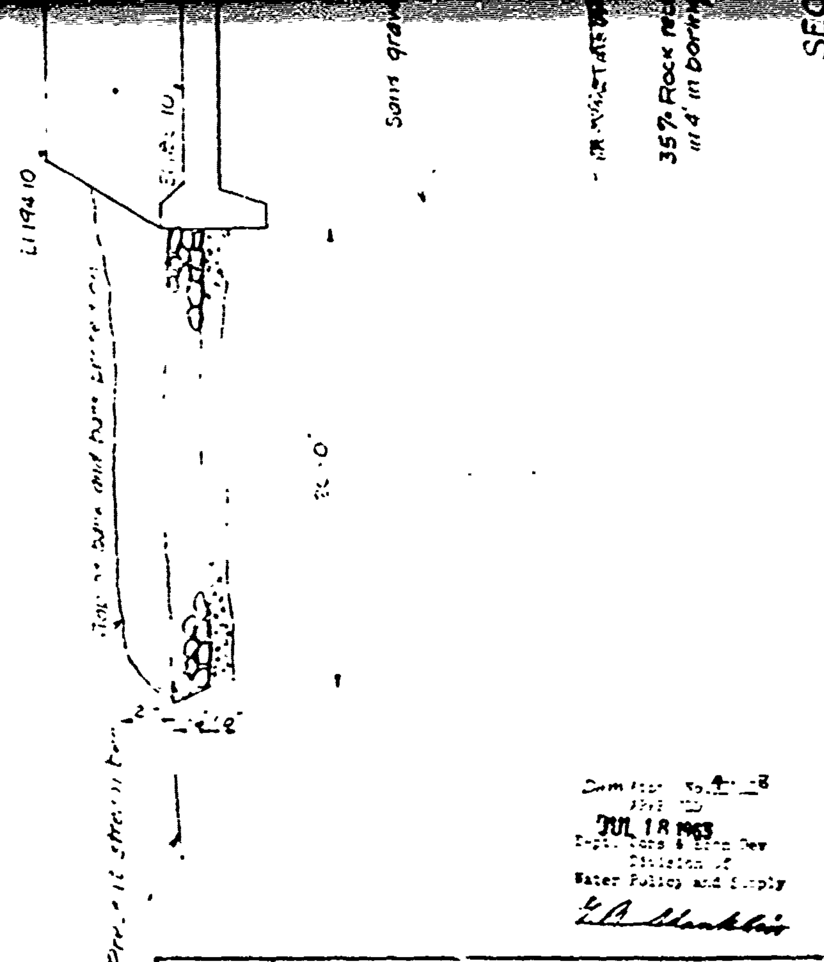
Construction joints 22'0"
8'0"
Second stage construction entire length of apron
10'-0
During each stage of construction the existing concrete slab that lies within will be removed. Excavated material will the banks of the stream
PLAN
A
Crest El 20
3" Drains
see sheet for detail
Spoil excavated from on banks
10'-0
Closure section of apron
Bed of sand and gravel

ELEVATION

5

-Present rock toe

...e bank protection into present rock toe



...g each stage of construction only the section of ...ing concrete slab that lies within the stage area ...e removed. Excavated material will be disposed on banks of the stream downstream of the spillway

Spoil excavation from stream bed on banks

Dam Ser. No. 4-8
JUL 18 1963
Division of Water Policy and Supply

REVISIONS	
	HARMON COLORS NATIONAL ANILINE DIVISION NORTH HALEDON N J
	OLDHAM POND DAM PROPOSED WEST CONCRETE SPILLWAY GENERAL PLAN
	CONSULTING ENGINEERS JUSTIN & COURTNEY PHILADELPHIA, U.S.A.

DRAWN BY	CHKD BY	APPROVED	DATE
J J W			MAY 1963
TRACED BY		SCALE	PLAN NO.
J S W		1" = 5'-0"	HW-1

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APPENDIX 5

REFERENCES

OLDHAM POND DAM

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OLDHAM POND DAM

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